10.7. **Model:** Model the oxygen and the helium atoms as particles.

Visualize: We denote the oxygen and helium atoms by O and He, respectively. Note that the oxygen atom is four times heavier than the helium atom, so $m_{\mathrm{O}} = 4\, m_{\mathrm{He}}$.

Solve: The energy conservation equation $K_{\mathrm{O}} = K_{\mathrm{He}}$ is

$$\frac{1}{2} m_{\mathrm{O}} v_{\mathrm{O}}^2 = \frac{1}{2} m_{\mathrm{He}} v_{\mathrm{He}}^2 \Rightarrow (4\, m_{\mathrm{He}}) v_{\mathrm{O}}^2 = m_{\mathrm{He}} v_{\mathrm{He}}^2 \Rightarrow \frac{v_{\mathrm{He}}}{v_{\mathrm{O}}} = 2.0$$

Assess: The result $v_{\mathrm{He}} = 2v_{\mathrm{O}}$, combined with the fact that $m_{\mathrm{He}} = \frac{1}{4} m_{\mathrm{O}}$, is a consequence of the way kinetic energy is defined: It is directly proportional to the mass and to the square of the speed.