

42. We divide Eq. 20-31 by Eq. 20-22:

$$\frac{v_{\text{avg}2}}{v_{\text{rms}1}} = \frac{\sqrt{8RT/\pi M_2}}{\sqrt{3RT/M_1}} = \sqrt{\frac{8M_1}{3\pi M_2}}$$

which leads to

$$\frac{m_1}{m_2} = \frac{M_1}{M_2} = \frac{3\pi}{8} \left(\frac{v_{\text{avg}2}}{v_{\text{rms}1}} \right)^2 = \frac{3\pi}{2} \quad \text{if } v_{\text{avg}2} = 2v_{\text{rms}1} \text{ .}$$