

7) 22.5 L container holds 1.00 mol of He at $P = 101 \text{ kPa}$
What is the rms speed of the molecules?

$$\frac{1}{2} m v_{\text{rms}}^2 = \frac{3}{2} kT$$

$$PV = NkT$$

$$kT = PV/N$$

$$= \frac{3}{2} \left(\frac{PV}{N} \right)$$

$$v_{\text{rms}} = \sqrt{\frac{3PV}{Nm}}$$

$$Nm = \text{total mass} = M$$

Helium: 4.0 g/mol & for 1 mol, $M = 4.0 \text{ g} = 4.0 \times 10^{-3} \text{ kg}$

$$v_{\text{rms}} = \left[\frac{3 \times 101 \times 10^3 \text{ Pa} \times 22.5 \text{ L} \times 10^{-3} \text{ m}^3/\text{L}}{4.0 \times 10^{-3} \text{ kg}} \right]^{1/2} = \sqrt{1.70 \times 10^6 \text{ m}^2/\text{s}^2}$$

$$= 1.3 \times 10^3 \text{ m/s} \quad (\text{E})$$