

All quantities on the right are given to us except n , which can be computed from the given mass of Ar.

$$n = \frac{25 \text{ g}}{39.95 \text{ g mol}^{-1}} = 0.626 \text{ mol}$$

$$\text{so } p = \frac{(0.626 \text{ mol}) \times (8.31 \times 10^{-2} \text{ dm}^3 \text{ bar K}^{-1} \text{ mol}^{-1}) \times (30 + 273 \text{ K})}{1.5 \text{ dm}^3} = \boxed{10.3 \text{ bar}}$$

not 2.0 bar.

(b) The van der Waals equation [1.21a] is

$$p = \frac{RT}{V_m - b} - \frac{a}{V_m^2}$$

$$\begin{aligned} \text{so } p &= \frac{(8.31 \times 10^{-2} \text{ dm}^3 \text{ bar K}^{-1} \text{ mol}^{-1}) \times (30 + 273) \text{ K}}{(1.5 \text{ dm}^3 / 0.626 \text{ mol}) - 3.20 \times 10^{-2} \text{ dm}^3 \text{ mol}^{-1}} \\ &\quad - \frac{(1.337 \text{ dm}^6 \text{ atm mol}^{-2}) \times (1.013 \text{ bar atm}^{-1})}{(1.5 \text{ dm}^3 / 0.626 \text{ mol})^2} = \boxed{10.4 \text{ bar}} \end{aligned}$$

E1.2(b) (a) Boyle's law [1.5] applies.

$$pV = \text{constant} \quad \text{so} \quad p_f V_f = p_i V_i$$

This equation can be solved for either initial or final pressure, hence

$$p_i = \frac{p_f V_f}{V_i} = \frac{(1.97 \text{ bar}) \times (2.14 \text{ dm}^3)}{(2.14 + 1.80) \text{ dm}^3} = \boxed{1.07 \text{ bar}}$$

(b) The original pressure in Torr is

$$p_i = (1.07 \text{ bar}) \times \left(\frac{1 \text{ atm}}{1.013 \text{ bar}} \right) \times \left(\frac{760 \text{ Torr}}{1 \text{ atm}} \right) = \boxed{803 \text{ Torr}}$$

E1.3(b) The relationship between pressure and temperature at constant volume can be derived from the perfect gas law, $pV = nRT$ [1.8]

$$\text{so } p \propto T \quad \text{and} \quad \frac{p_i}{T_i} = \frac{p_f}{T_f}$$

The final pressure, then, ought to be

$$p_f = \frac{p_i T_f}{T_i} = \frac{(125 \text{ kPa}) \times (11 + 273) \text{ K}}{(23 + 273) \text{ K}} = \boxed{120 \text{ kPa}}$$

E1.4(b) According to the perfect gas law [1.8], one can compute the amount of gas from pressure, temperature, and volume.

$$pV = nRT$$

$$\text{so } n = \frac{pV}{RT} = \frac{(1.00 \text{ atm}) \times (1.013 \times 10^5 \text{ Pa atm}^{-1}) \times (4.00 \times 10^3 \text{ m}^3)}{(8.3145 \text{ J K}^{-1} \text{ mol}^{-1}) \times (20 + 273) \text{ K}} = 1.66 \times 10^5 \text{ mol}$$

Physical Chemistry 9th Solution Manual

JG Myers



Physical Chemistry 9th Solution Manual:

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