Solutions

Each answer shows the steps, then the **result**.

2.1

- the particles have zero volume; there are no intermolecular forces of attraction

2.2

- $25 + 273 = 298$ K

3.1 B

- Low pressure and high temperature (particles far apart, forces negligible)

3.2 B

- Temperature must be in kelvin

3.3

- $T = 400$ K; $V = nRT/p = (2.0 \times 8.31 \times 400)/(2.0 \times 10^5) = 0.0332$ m^3

3.4

- convert: $V = 7.50 \times 10^{-4}$ m^3, $T = 300$ K, $p = 1.00 \times 10^5$ Pa; $M = \dfrac{mRT}{pV} = \dfrac{1.32 \times 8.31 \times 300}{(1.00 \times 10^5)(7.50 \times 10^{-4})} = 43.9$ g mol^{-1}

3.5

(a)

- $V = 250 \times 10^{-6}$ m^3, $T = 298$ K, $p = 1.01 \times 10^5$ Pa; $n = \dfrac{pV}{RT} = \dfrac{1.01 \times 10^5 \times 2.50 \times 10^{-4}}{8.31 \times 298} = 1.02 \times 10^{-2}$ mol

(b)

- $M_r = \dfrac{m}{n} = \dfrac{0.286}{1.02 \times 10^{-2}} = 28.0$; so **G** could be nitrogen, N_2, or carbon monoxide, CO

(c)

- The molecules themselves occupy a negligible fraction of the container's volume; there are no attractive forces between them. At 500 kPa the molecules are five times closer together, so it is the **no-attraction** assumption that fails first — the attractions pull the molecules together, so the real gas is more compressible than $pV = nRT$ predicts

(d)

- Air left behind means the measured mass increase is less than the true mass of **G**, while n is still calculated from the full pressure — so the M_r comes out **too low**