

0.30 mol of argon gas at 25°C is admitted into an evacuated 75 cm<sup>3</sup> chamber. The gas undergoes isothermal expansion to a volume of 300 cm<sup>3</sup>. What is the final pressure of the gas?

Given:

Number of moles of argon gas:

$$n = 0.30 \text{ mol}$$

Initial temperature of gas:

$$T_i = 25^\circ\text{C} = 298 \text{ K}$$

Initial volume of gas:

$$V_i = 75 \text{ cm}^3 = 75 \times 10^{-6} \text{ m}^3$$

Final volume of gas:

$$V_f = 300 \text{ cm}^3 = 300 \times 10^{-6} \text{ m}^3$$

Determine: Final volume of gas: P<sub>f</sub>

$$P_f V_f = n R T_f \text{ --- (1)}$$

**R is the gas constant and has a value of 8.314 J / mol**

Since this is an isothermal expansion, T<sub>i</sub> = T<sub>f</sub>.

Rearranging (1) and substituting for V<sub>f</sub>, n, R, and T<sub>f</sub> in (1):

$$P_f = n R T_f / V_f = (0.3 \times 8.314 \times 298) / (300 \times 10^{-6}) = 2.5 \times 10^6 \text{ pa}$$