$$\frac{n_p}{n_{ar}} = \frac{\left(\frac{m_p}{M}\right)}{\left(\frac{pV}{RT}\right)} = \left(\frac{RT}{pM}\right)\left(\frac{m_p}{V}\right)$$

$$\frac{RT}{p} = \frac{8.3145\ \mathrm{J\,K^{-1}\,mol^{-1}} \times (25+273)\ \mathrm{K}}{1.01325 \times 10^5\ \mathrm{Pa}}$$

$$= 2.445 \times 10^{-2}\ \mathrm{m^3\,mol^{-1}}$$

$$= 24.45\ \mathrm{L\,mol^{-1}}$$

$$\frac{n_p}{n_{ar}} = \left(\frac{2.445 \times 10^{-2}\ \mathrm{m^3\,mol^{-1}}}{M\left(\mathrm{kg\,mol^{-1}}\right)}\right)\left(\frac{m_p\,(\mathrm{kg})}{V\left(\mathrm{m^3}\right)}\right)$$

$$\frac{n_p}{n_{ar}} = \left(\frac{2.445 \times 10^{-2}\ \mathrm{m^3\,mol^{-1}} \times \frac{10^3\,\mathrm{L}}{\mathrm{m^3}}}{M\left(\mathrm{kg\,mol^{-1}}\right) \times \frac{10^3\,\mathrm{g}}{\mathrm{kg}}}\right)\left(\frac{m_p\,(\mathrm{kg}) \times \frac{10^3\,\mathrm{g}}{\mathrm{kg}}}{V\left(\mathrm{m^3}\right) \times \frac{10^3\,\mathrm{L}}{\mathrm{m^3}}}\right)$$

$$\frac{n_p}{n_{ar}} = \left(\frac{24.45\ \mathrm{L\,mol^{-1}}}{M\left(\mathrm{g\,mol^{-1}}\right)}\right)\left(\frac{m_p\,(\mathrm{g})}{V\,(\mathrm{L})}\right)$$

$$\frac{n_p}{n_{ar}} = \left(\frac{24.45\ \mathrm{L\,mol^{-1}}}{M\left(\mathrm{g\,mol^{-1}}\right)}\right)\left(\frac{m_p\,(\mathrm{g}) \times \frac{10^6\,\mu\mathrm{g}}{\mathrm{g}}}{V\,(\mathrm{L})}\right)$$

$$\frac{n_p}{n_{ar}} = \left(\frac{24.45\ \mathrm{L\,mol^{-1}}}{M\left(\mathrm{g\,mol^{-1}}\right)}\right)\left(\frac{m_p\,(\mu\mathrm{g})}{V\,(\mathrm{L})}\right) \times 10^6 = 10^6\ ppmv$$

$$ppmv = \left(\frac{24.45\ \mathrm{L\,mol^{-1}}}{M\left(\mathrm{g\,mol^{-1}}\right)}\right)\left(\frac{m_p\,(\mu\mathrm{g})}{V\,(\mathrm{L})}\right)$$

Exemplo:
SO_2 tem uma massa molar de $\left(M_S = 32\,\mathrm{g\,mol^{-1}},\ M_O = 16\,\mathrm{g\,mol^{-1}}\right)$ $M_{SO_2} = 64\,\mathrm{g\,mol^{-1}}$
$m_p = 17\,\mu\mathrm{g}$, $V_m = 500\,\mathrm{L} = 0.500\,\mathrm{m^3}$
As medições são obtidas à temperatura de $T_m = 15\,^{\circ}\mathrm{C}$ e à pressão de $p_m = 0.998\ \times 10^5$ Pa
Primeiro calcula-se o volume normalizado:

$$\frac{pV}{T} = \frac{p_m V_m}{T_m}$$

$$V = V_m\left(\frac{p_m}{p}\frac{T}{T_m}\right)$$

$$V = (500\,\mathrm{L})\left(\frac{0.998\ \times 10^5\ \mathrm{Pa}}{1.01325\ \times 10^5\ \mathrm{Pa}}\frac{(25+273)\ \mathrm{K}}{(15+273)\ \mathrm{K}}\right)$$

$$V = 509.6\,\mathrm{L}$$

$$ppmv = \left(\frac{24.45\ \mathrm{L\,mol^{-1}}}{64\,\mathrm{g\,mol^{-1}}}\right)\left(\frac{17\,\mu\mathrm{g}}{509.6\,\mathrm{L}}\right)$$

$$ppmv = 0.0128\ \mathrm{ppm}$$