Conversion Factors

Conversion of ppm (Mole Basis) to Grams per Liter

Example: Given a 100 ppm (mole basis) gas mixture of Compound A in nitrogen, how much of Compound A will be contained in a 1 liter volume?

Key Assumptions

- Temperature of sample is assumed to be at 21.1°C (70°F).
- Pressure of sample is assumed to be 1 atm just before injection. At around atmospheric pressure, gases behave in close to ideal manner.

Calculations

Using the Ideal Gas Law (PV = nRT) for a temperature of 294.1°K (21.1°C), a pressure of 1 atm, and the gas constant R of 0.0821 liter x atm/mole x degree K, we find that 1 mole of ideal gas occupies 24.15 liters.

One liter of gas will then contain (1/24.15) moles. Since the concentration of Compound A is 100 ppm, the total number of moles of Compound A in 1 liter is:

(total # moles per liter) x (concentration of Compound A)

The concentration of 100 ppm (parts per million) is unit-less, and equals 100 mole-parts per 1,000,000 total moles = 0.000100 in decimal form; thus the amount of moles of Compound A in one liter of mixture is:

(1/24.15) moles per liter x 0.000100 = 0.000004 moles of Compound A per liter

In order to find the weight of Compound A, we need to know its molecular weight. For example, if Compound A is hydrogen sulfide, with a molecular weight of 34.08 gram/mole, we obtain the following concentration:

0.000004 moles per liter x 34.08 gram per mole =
0.000140 gram per liter or 0.140 milligram per liter

General Formula for Conversion of ppm (mole) to grams per liter for Gas Mixtures

(for temperature 21.1°C (70°F) and pressure 1 atm)

$$\frac{\{\text{Concentration (decimal form) x mole-weight (gram/mole)}\} \text{ of Comp A}}{24.15 \text{ liter/mole}} = \text{Concentration of Comp A in g/l}$$

Conversion of grams per liter to ppm (mole basis) for Gas Mixture

(for temperature 21.1°C (70°F) and pressure 1 atm)

$$\frac{\text{Concentration of Comp A in gram/liter x 24.15 liter/mole}}{\text{Mole-Weight of Comp A in gram/mole}} = \text{Concentration of Comp A in decimal form}$$

The concentration expressed in decimal form is unit-less. To find the concentration of Compound A in ppm, multiply the answer from equation above with 1,000,000. For example, a concentration of Compound A of 0.000100 (decimal form from equation above) would be 100 ppm, while a concentration of 0.010000 would be 10,000 ppm or 1%.