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CHARACTERISTICS OF THE COMPOSITION OF SOLUTIONS

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THE quantity of a component of a mixture can be described clearly by one of its extensive characteristics, i.e., those that are proportional to the mass quantity. To these belong the mass m, the volume V (for a fixed temperature and pressure), the weight G (in the sense of the normal weight according to DIN 1305), the mol number n, the molecular number or atomic number N.

An indication of the intensity of the composition of a solid, liquid or gaseous mixture, which is independent of the total quantity of the mixture, can be given by any *quotient* of any extensive quantity characteristic of each component, and of an extensive quantity characteristic of the total mixture or of the solvent.

The following quotients can be used:

$$\textit{mass-concentration} = \frac{\text{mass of the component}}{\text{volume of the mixture}} \quad \text{e.g. g/100cm}^3\text{, g/l., mg/100 cm}^3.$$

$$\textit{mass-content} = \frac{\text{mass of the component}}{\text{mass of the mixture}}$$

$$\textit{mass-ratio} = \frac{\text{mass of the component}}{\text{mass of the solvent}}$$

$$\textit{volume-ratio} = \frac{\text{volume of component before solution}}{\text{volume of solvent before solution}}$$

$$\textit{mol number concentration} = n/V = \frac{\text{mol number of the component}}{\text{volume of the solution}}$$

atomic number concentration or *molecular number concentration* $= N/V =$

$$\frac{\text{atomic number (or molecular number) of the component}}{\text{volume of the solution}}$$

Dimension: [volume]$^{-1}$. For the same solution $N/V = 6{\cdot}02 \times 10^{23}.n/V$ e.g. $N/\text{cm}^3 = 6{\cdot}02 \times 10^{23}\ n/\text{cm}^3 = 6{\cdot}02 \times 10^{20}.n/\text{l.}$

$$\textit{quantity of material-concentration} = \frac{\text{quantity of material of component } i}{\text{volume of solution}}$$

$= n$ mol$/V = N$ atoms$/V$; Dimension = [quantity of material]/[volume], e.g.: n mol/l.; here n is equal to the *molarity* in chemistry.

molar fraction (also known as mol number fraction), e.g. for the component A in a binary solution with the solvent $B = n_A/(n_A + n_B)$.

molar-ratio (also known as mol number ratio) for the component A in a binary solution with the solvent $B = n_A/n_B$.

The *molality* of the dissolved component A in the binary solution with the solvent B gives the mol number n_A in the quotient n_A mol A/kg B. In contrast to the 'molarity', it is independent of p and T.

For components with the valence $z = 2, 3, \ldots$ instead of the mol number n, one can also use the equivalent number which represents z times the amount of the usual mol number. Thus, for example, the 'molarity' of a solution is transposed into the 'normality' which is z times greater.

Quotients with the numerical value (mass number) = 100 in the denominator are often called percentages, e.g. percentage weight of the component A in the sense of xg/100 g solution. In so far, however, that such terminology is ambiguous, it is not recommended.

Quotients that have terms of the same kind of magnitude in the numerator and denominator, become sufficiently clear by giving the numerical value (mass number) *and* the units used. For all results that contain a volume, the temperature and pressure must be stated specifically.