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| --- | --- | --- |
| Variable | Physical quantity | Physical unit |
|  | Mole fraction based activity of the substance | 1 |
|  | Molality of the substance | mol.kg‑1 |
|  | Molarity of the substance | mol.m‑3 |
|  | Hydraulic compliance of space with elastic walls | m3.Pa‑1 |
|  | Specific molar heat capacity at constant pressure | J.K‑1.mol‑1 |
|  | Donnan’s equilibrium ratio of monovalent ion | 1 |
|  | Gibbs energy | J |
|  | Free molar Gibbs energy of formation of the substance at T0, p0 | J.mol‑1 |
|  | Vertical height between two points | m |
|  | Enthalpy; Heat energy | J |
|  | Change of heat energy; heat flow | J.s‑1 |
|  | Molar enthalpy of the substance | J.mol‑1 |
|  | Free molar enthalpy of formation of the substance at T0 | J.mol‑1 |
|  | Henry’s law coefficient as liquid to gas ratio | 1 |
|  | Kinetics coefficient of chemical process | mol2.J-1.s-1 |
|  | Dissociation coefficient of the chemical reaction | 1 |
|  | Hydraulic inertia | Pa.s2.m‑3 |
|  | Mass | kg |
|  | Change of mass; mass flow | kg.s-1 |
|  | Molar mass of the substance | kg-1.mol-1 |
|  | Amount of the substance | mol |
|  | Change of the amount of substance; molar flow | mol.s‑1 |
|  | Pressure | Pa |
|  | Electric charge | C |
|  | Hydraulic resistance | m-3.Pa.s |
|  | Entropy | J.K-1 |
|  | Molar entropy of the substance | J.K-1.mol‑1 |
|  | Temperature | K |
|  | Internal energy | J |
|  | Stoichiometry coefficient in the chemical reaction | 1 |
|  | Volume | m3 |
|  | Change of volume or volumetric flow | m3.s‑1 |
|  | Molar volume of the substance | m3.mol-1 |
|  | Mole fraction of the substance | mol.mol‑1 |
|  | Electrical charge of one particle of the substance | C |
|  | Osmotic pressure | Pa |
|  | Mole fraction based activity coefficient of substance | 1 |
|  | Heat conductance of heat convection | J.K‑1.s‑1.m‑2 |
|  | Size of cell population; number of cells | 1 |
|  | Change of cell population; flow of cells | s‑1 |
|  | Change of population per one cell | s‑1 |
|  | Electrochemical potential of the chemical substance | J.mol-1 |
|  | Time coefficient of equilibration of electrochemical potentials | S |
|  | Electric potential | V |
|  | Density | kg.m‑3 |

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| Chemical variables definitions | | |
|  | | **Amount of substance** A |
|  | | **Mole fraction** of the substance A |
|  | | Mole fraction based **activity** of the substance A |
|  | | **Electrochemical potential** of the substance A in the solution |
|  | | **Chemical potential of the pure substance A** |
|  | | Molar enthalpy and molar entropy of **ideal gas** |
|  | |
|  | | Molar enthalpy and molar entropy of **incompressible** liquid or solid |
|  | |
|  | | **Rate of chemical process**  *0 <->* v1*A1 +* v2*A2 + ...* , where vi is negative for reactants |
|  | | Molar change of the substance |
|  |  | **Extensive properties** of the homogenous chemical solution (amount of substance, mass, volume, enthalpy, entropy, electric charge) |
|  | | **Internal energy** of the chemical solution |
|  | | **Gibbs energy** of the chemical solution |
|  | | Equilibrium of the **specific macromolecule form S** composed from the specific independent primary structure subunits Pi in the macromolecule quaternary structure Q |
|  | | Kirchhoff’s **junction** rule for molar flows |

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| Recalculation of chemical parameters from substance properties | |
|  | Equilibrium (dissociation) coefficient of the chemical reaction |
|  | Osmotic pressure (equilibrium of each uncharged permeable substance across membrane) |
|  | Membrane potential (equilibrium of each charged permeable substance across membrane) |
|  | Henry’s coefficient (equilibrium of gas dissolution in liquid) |
|  | Molar enthalpy change of gass dissolution from Henry’s constant C |
| Water solution: | Recalculation of Henry’s coefficients. M is molar mass of solvent in ‘kg/mol’, is Henry’s coefficient in ‘mol/kg\*bar’ as presented by NIST[[1]](#footnote-1) at 25°C and 1 bar. |
|  | Raoult’s vapor pressure (vaporization equilibrium) |
|  | Sieverts’ coefficient (equilibrium of gas dissolution in solids) |
|  | Molar volume of the substance A from its osmotic pressure at 25°C and 1 bar. |
|  | Donnan’s equilibrium coefficient of ions with charge +1 at 25°C and 1 bar:  D=Cationin/Cationout |

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| Thermal equations | |
|  | **Heat** accumulation |
|  | **Temperature** |
|  | **Heat convection** |
|  | Change of heat by **vaporization** of water |
|  | **Ideal radiator**  (e.g. microcirculation) |
|  | Kirchhoff’s **junction** rule for heat flows |

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| Population equations | |
|  | **Size of population** |
|  | **Change of population** |
|  | Kirchhoff’s **junction** rule for population flows |

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| Hydraulic equations | |
|  | **Volume** accumulation |
|  | **Pressure** in container with elastic walls (e.g. blood or lymph vessels) |
|  | Hydraulic **resistance** /conductance |
|  | **Pascal’s law** |
|  | Idealized hydraulic **valve** |
|  | Hydraulic **inertia** |
|  | Kirchhoff’s **junction** rule for volumetric flows |

1. U.S. Department of Commerce: National Institute of Standards and Technology (<http://webbook.nist.gov/chemistry/>) [↑](#footnote-ref-1)