SYMBOLS AND TERMINOLOGY FOR PHYSICAL AND CHEMICAL QUANTITIES

The International Organization for Standardization (ISO), International Union of Pure and Applied Chemistry (IUPAC), and the International Union of Pure and Applied Physics (IUPAP) have jointly developed a set of recommended symbols for physical and chemical quantities. Consistent use of these recommended symbols helps assure unambiguous scientific communication. The list below is reprinted from Reference 1 with permission from IUPAC. Full details may be found in the following references:

1. Ian Mills, Ed., *Quantities, Units, and Symbols in Physical Chemistry,* Blackwell Scientific Publications, Oxford, 1988. Third Edition: RSC Publishing, Cambridge, UK, 2007.
2. E. R. Cohen and P. Giacomo, *Symbols, Units, Nomenclature, and Fundamental Constants in Physics*, Document IUPAP–25, 1987; also published in *Physica* 146A, 1–68, 1987.
3. *ISO Standards Handbook 2: Units of Measurement*, International Organization of Standardization, Geneva, 1982.

GENERAL RULES

The value of a physical quantity is expressed as the product of a numerical value and a unit, e.g.:

T = 300 K
V = 26.2 cm^3
C_p = 45.3 J mol^{-1} K^{-1}

The symbol for a physical quantity is always given in italic (sloping) type, while symbols for units are given in roman type. Column headings in tables and axis labels on graphs may conveniently be written as the physical quantity symbol divided by the unit symbol, e.g.:

T/K
V/cm^3
C_p/J mol^{-1} K^{-1}

The values in the table or graph axis are then pure numbers. Subscripts to symbols for physical quantities should be italic if the subscript refers to another physical quantity or to a number, e.g.:

C_p – heat capacity at constant pressure
B_n – nth virial coefficient

Subscripts that have other meanings should be in roman type:

m_p – mass of the proton
E_k – kinetic energy

The following tables give the recommended symbols for the major classes of physical and chemical quantities. The expression in the Definition column is given as an aid in identifying the quantity but is not necessarily the complete or unique definition. The SI Unit gives one (not necessarily unique) expression for the coherent SI unit for the quantity. Other equivalent unit expressions, including those that involve SI prefixes, may be used.

Name	Symbol	Definition	SI unit
Space and Time			
cartesian space coordinates	x, y, z		m
spherical polar coordinates	r, θ, ϕ		m, 1, 1
generalized coordinate	q, q_i		(varies)
position vector	r	$r = x\boldsymbol{i} + y\boldsymbol{j} + z\boldsymbol{k}$	m
length	l		m
special symbols:			
height	h		
breadth	b		
thickness	d, δ		
distance	d		
radius	r		
diameter	d		
path length	s		
length of arc	s		
area	A, A_s, S		m^2
volume	$V, (v)$		m^3
plane angle	$\alpha, \beta, \gamma, \theta, \phi\ldots$	$\alpha = s/r$	rad, 1
solid angle	ω, Ω	$\omega = A/r^2$	sr, 1
time	t		s
period	T	$T = t/N$	s
frequency	ν, f	$\nu = 1/T$	Hz
circular frequency, angular frequency	ω	$\omega = 2\pi\nu$	rad s^{-1}, s^{-1}
characteristic time interval, relaxation time, time constant	τ, T	$\tau = \lvert \mathrm{d}t/\mathrm{d}\ln x \rvert$	s
angular velocity	ω	$\omega = \mathrm{d}\phi/\mathrm{d}t$	rad s^{-1}, s^{-1}
velocity	$\boldsymbol{v}, \boldsymbol{u}, \boldsymbol{w}, \boldsymbol{c}, \dot{\boldsymbol{r}}$	$v = \mathrm{d}\boldsymbol{r}/\mathrm{d}t$	m s^{-1}

Name	Symbol	Definition	SI unit
speed	v, u, w, c	$v = \lvert\boldsymbol{v}\rvert$	m s^{-1}
acceleration	$\boldsymbol{a}, (g)$	$\boldsymbol{a} = \mathrm{d}\boldsymbol{v}/\mathrm{d}t$	m s^{-2}
Classical Mechanics			
mass	m		kg
reduced mass	μ	$\mu = m_1 m_2/(m_1 + m_2)$	kg
density, mass density	ρ	$\rho = m/V$	kg m^{-3}
relative density	d	$d = \rho/\rho$	1
surface density	ρ_A, ρ_S	$\rho_A = m/A$	kg m^{-2}
specific volume	v	$v = V/m = 1/\rho$	m^3 kg^{-1}
momentum	$\boldsymbol{p}$	$\boldsymbol{p} = m\boldsymbol{v}$	kg m s^{-1}
angular momentum, action	$\boldsymbol{L}$	$\boldsymbol{L} = \boldsymbol{r} \times \boldsymbol{p}$	J s
moment of inertia	I, J	$I = \Sigma m_i r_i^2$	kg m^2
force	$\boldsymbol{F}$	$\boldsymbol{F} = \mathrm{d}\boldsymbol{p}/\mathrm{d}t = m\boldsymbol{a}$	N
torque, moment of a force	$\boldsymbol{T}, (\boldsymbol{M})$	$\boldsymbol{T} = \boldsymbol{r} \times \boldsymbol{F}$	N m
energy	E		J
potential energy	E_p, V, Φ	$E_p = \int \boldsymbol{F} \cdot ds$	J
kinetic energy	E_κ, T, K	$E_k = 1/2mv^2$	J
work	W, w	$W = \int \boldsymbol{F} \cdot ds$	J
Hamilton function	H	$H(q, p) = T(q, p) + V(q)$	J
Lagrange function	L	$L(q, \dot{q}) = T(q, \dot{q}) - V(q)$	J
pressure	p, P	$p = F/A$	Pa, N m^{-2}
surface tension	γ, σ	$y = \mathrm{d}W/\mathrm{d}A$	N m^{-1}, J m^{-2}
weight	$G, (W, P)$	$G = mg$	N
gravitational constant	G	$F = Gm_1 m_2/r^2$	N m^2 kg^{-2}
normal stress	σ	$\sigma = F/A$	Pa
shear stress	τ	$\tau = F/A$	Pa
linear strain, relative elongation	ε, e	$\varepsilon = \Delta l/l$	1
modulus of elasticity, Young's modulus	E	$E = \sigma/\varepsilon$	Pa
shear strain	γ	$\gamma = \Delta x/d$	1
shear modulus	G	$G = \tau/\gamma$	Pa
volume strain, bulk strain	θ	$\theta = \Delta V/V_0$	1
bulk modulus, compression modulus	K	$K = -V_0(\mathrm{d}p/\mathrm{d}V)$	Pa
viscosity, dynamic viscosity	η, μ	$\tau_{x,z} = \eta(\mathrm{d}v_x/\mathrm{d}z)$	Pa s
fluidity	ϕ	$\phi = 1/\eta$	m kg^{-1} s
kinematic viscosity	ν	$\nu = \eta/\rho$	m^2 s^{-1}
friction coefficient	$\mu, (f)$	$F_\mathrm{frict} = \mu F_\mathrm{norm}$	1
power	P	$P = \mathrm{d}W/\mathrm{d}t$	W
sound energy flux	P, P_a	$P = \mathrm{d}E/\mathrm{d}t$	W
acoustic factors			
reflection factor	ρ	$\rho = P_\mathrm{r}/P_0$	1
acoustic absorption factor	$\alpha_a, (\alpha)$	$\alpha_a = 1 - \rho$	1
transmission factor	τ	$\tau = P_\mathrm{tr}/P_0$	1
dissipation factor	δ	$\delta = \alpha_a - \tau$	1
Electricity and Magnetism			
quantity of electricity, electric charge	Q		C
charge density	ρ	$\rho = Q/V$	C m^{-3}
surface charge density	σ	$\sigma = Q/A$	C m^{-2}
electric potential	V, ϕ	$V = \mathrm{d}W/\mathrm{d}Q$	V, J C^{-1}
electric potential difference	$U, \Delta V, \Delta\phi$	$U = V_2 - V_1$	V
electromotive force	E	$E = \int(\boldsymbol{F}/Q) \cdot ds$	V
electric field strength	$\boldsymbol{E}$	$\boldsymbol{E} = \boldsymbol{F}/Q = -\operatorname{grad} V$	V m^{-1}
electric flux	Ψ	$\Psi = \int \boldsymbol{D} \cdot \mathrm{d}\boldsymbol{A}$	C
electric displacement	$\boldsymbol{D}$	$\boldsymbol{D} = \varepsilon\boldsymbol{E}$	C m^{-2}
capacitance	C	$C = Q/U$	F, C V^{-1}
permittivity	ε	$\boldsymbol{D} = \varepsilon\boldsymbol{E}$	F m^{-1}
permittivity of vacuum	ε_0	$\varepsilon_0 = \mu_0^{-1} c_0^{-2}$	F m^{-1}
relative permittivity	ε_r	$\varepsilon_r = \varepsilon/\varepsilon_0$	1
dielectric polarization (dipole moment per volume)	$\boldsymbol{P}$	$\boldsymbol{P} = \boldsymbol{D} - \varepsilon_0\boldsymbol{E}$	C m^{-2}
electric susceptibility	χ_e	$\chi_e = \varepsilon r - 1$	1
electric dipole moment	$\boldsymbol{p}, \boldsymbol{\mu}$	$\boldsymbol{p} = Q\boldsymbol{r}$	C m

Name	Symbol	Definition	SI unit
electric current	I	$I = \mathrm{d}Q/\mathrm{d}t$	A
electric current density	$\boldsymbol{j}, \boldsymbol{J}$	$I = \int \boldsymbol{j} \cdot \mathrm{d}\boldsymbol{A}$	A m^{-2}
magnetic flux density, magnetic induction	$\boldsymbol{B}$	$\boldsymbol{F} = Q\boldsymbol{v} \times \boldsymbol{B}$	T
magnetic flux	Φ	$\Phi = \int \boldsymbol{B} \cdot \mathrm{d}\boldsymbol{A}$	A m^{-2}
magnetic field strength	$\boldsymbol{H}$	$\boldsymbol{B} = \mu\boldsymbol{H}$	A m^{-2}
permeability	μ	$\boldsymbol{B} = \mu\boldsymbol{H}$	N A^{-2}, H m^{-1}
permeability of vacuum	μ_0		H m^{-1}
relative permeability	μ_r	$\mu_r = \mu/\mu_0$	1
magnetization (magnetic dipole moment per volume)	$\boldsymbol{M}$	$\boldsymbol{M} = \boldsymbol{B}/\mu_0 - H$	A m^{-1}
magnetic susceptibility	$\chi, \kappa, (\chi_m)$	$\chi = \mu_r - 1$	1
molar magnetic susceptibility	χ_m	$\chi_m = V_m\chi$	m^3 mol^{-1}
magnetic dipole moment	$\boldsymbol{m}, \boldsymbol{\mu}$	$E_p = -\boldsymbol{m} \cdot \boldsymbol{B}$	A m^2, J T^{-1}
electrical resistance	R	$R = U/I$	Ω
conductance	G	$G = 1/R$	S
loss angle	δ	$\delta = (\pi/2) + \phi_I - \phi_U$	1, rad
reactance	X	$X = (U/I)\sin\delta$	Ω
impedance (complex impedance)	Z	$Z = R + iX$	Ω
admittance (complex admittance)	Y	$Y = 1/Z$	S
susceptance	B	$Y = G + \mathrm{i}B$	S
resistivity	ρ	$\rho = E/j$	Ω m
conductivity	κ, γ, σ	$\kappa = 1/\rho$	S m^{-1}
self-inductance	L	$E = -L(\mathrm{d}I/\mathrm{d}t)$	H
mutual inductance	M, L_{12}	$E_1 = L_{12}(\mathrm{d}I_2/\mathrm{d}t)$	H
magnetic vector potential	$\boldsymbol{A}$	$\boldsymbol{B} = \nabla \times \boldsymbol{A}$	Wb m^{-1}
Poynting vector	$\boldsymbol{S}$	$\boldsymbol{S} = \boldsymbol{E} \times \boldsymbol{H}$	W m^{-2}
Quantum Mechanics			
momentum operator	$\dot{\boldsymbol{p}}$	$\dot{\boldsymbol{p}} = -\mathrm{i}h\nabla$	m^{-1} J s
kinetic energy operator	$\hat{T}$	$\hat{T} = -(h^2/2m)\nabla^2$	J
Hamiltonian operator	$\hat{H}$	$\hat{H} = \hat{T} + V$	J
wavefunction, state function	Ψ, ψ, ϕ	$\hat{H}\psi = E\psi$	(m$^{-3/2}$)
probability density	P	$P = \psi^*\psi$	(m^{-3})
charge density of electrons	ρ	$\rho = -eP$	(C m^{-3})
probability current density	$\boldsymbol{S}$	$\boldsymbol{S} = -i\hbar(\psi^*\nabla\psi - \psi\nabla\psi^*)/2m_e$	(m^{-2} s^{-1})
electric current density of electrons	$\boldsymbol{j}$	$\boldsymbol{j} = -e\boldsymbol{S}$	(A m^{-2})
matrix element of operator Â	$A_{ij}, \langle i\vert\hat{A}\vert j\rangle$	$A_{ij} = \int\psi_i^*\hat{A}\psi_j\mathrm{d}\tau$	(varies)
expectation value of operator Â	$\langle A\rangle, \bar{A}$	$\langle A\rangle = \int\psi^*\hat{A}\Psi\mathrm{d}\tau$	(varies)
hermitian conjugate of Â	$\hat{A}^\dagger$	$(\hat{A}^\dagger)_{ij} = (A_{ji})^*$	(varies)
commutator of Â and $\hat{B}$	$[\hat{A}, \hat{B}], [\hat{A}, \hat{B}]_-$	$[\hat{A}\hat{B}] = \hat{A}\hat{B} - \hat{B}\hat{A}$	(varies)
anticommutator	$[\hat{A}, \hat{B}]_+$	$[\hat{A}, \hat{B}]_+ = \hat{A}\hat{B} + \hat{B}\hat{A}$	(varies)
spin wavefunction	$\alpha; \beta$		1
coulomb integral	H_{AA}	$H_{\mathrm{AA}} = \int\psi_{\mathrm{A}}^*\hat{H}\psi_{\mathrm{A}}\mathrm{d}\tau$	J
resonance integral	H_{AB}	$H_{\mathrm{AB}} = \int\psi_{\mathrm{A}}^*\hat{H}\psi_{\mathrm{B}}\mathrm{d}\tau$	J
overlap integral	S_{AB}	$S_{\mathrm{AB}} = \int\psi_{\mathrm{A}}^*\psi_{\mathrm{B}}\mathrm{d}\tau$	1
Atoms and Molecules			
nucleon number, mass number	A		1
proton number, atomic number	Z		1
neutron number	N	$N = A - Z$	1
electron rest mass	m_e		kg
mass of atom, atomic mass	m_a, m		kg
atomic mass constant	m_u	$m_u = m_a(^{12}C)/12$	kg
mass excess	Δ	$\Delta = m_a - Am_u$	kg
elementary charge, proton charge	e		C
Planck constant	h		J s
Planck constant/2π	$\hbar$	$\hbar = h/2\pi$	J s
Bohr radius	a_0	$a_0 = 4\pi\varepsilon_0\hbar^2/m_e e^2$	m
Hartree energy	E_h	$E_\hbar = \hbar^2/m_e a_0^{\,2}$	J
Rydberg constant	R_∞	$R_\infty = E_h/2hc$	m^{-1}
fine structure constant	α	$\alpha = e^2/4\pi\varepsilon_0\hbar c$	1

Name	Symbol	Definition	SI unit
ionization energy	E_i		J
electron affinity	E_ea		J
dissociation energy	E_d, D		J
from the ground state	D_0		J
from the potential minimum	D_e		J
principal quantum number (H atom)	n	$E = -hcR/n^2$	1
angular momentum quantum numbers	see under Spectroscopy		
magnetic dipole moment of a molecule	$\boldsymbol{m},\boldsymbol{\mu}$	$E_p = -\boldsymbol{m} \cdot \boldsymbol{B}$	$\mathrm{J\ T^{-1}}$
magnetizability of a molecule	ξ	$\boldsymbol{m} = \xi B$	$\mathrm{J\ T^{-2}}$
Bohr magneton	μ_B	$\mu_\mathrm{B} = e\hbar/2m_e$	$\mathrm{J\ T^{-1}}$
nuclear magneton	μ_N	$\mu_\mathrm{N} = (m_e/m_p)\mu_B$	$\mathrm{J\ T^{-1}}$
magnetogyric ratio (gyromagnetic ratio)	γ	$\gamma = \mu/L$	$\mathrm{C\ kg^{-1}}$
g factor	g		1
Larmor circular frequency	ω_L	$\omega_\mathrm{L} = (e/2m)B$	$\mathrm{s^{-1}}$
Larmor frequency	ν_L	$\nu_\mathrm{L} = \omega_\mathrm{L}/2\pi$	Hz
longitudinal relaxation time	T_1		s
transverse relaxation time	T_2		s
electric dipole moment of a molecule	$\boldsymbol{p}, \boldsymbol{\mu}$	$E_\mathrm{p} = -\boldsymbol{p} \cdot \boldsymbol{E}$	C m
quadrupole moment of a molecule	$\boldsymbol{Q}; \boldsymbol{\Theta}$	$E_\mathrm{p} = 1/2\boldsymbol{Q}: \boldsymbol{V}'' = 1/3\boldsymbol{\Theta}: \boldsymbol{V}''$	$\mathrm{C\ m^2}$
quadrupole moment of a nucleus	eQ	$eQ = 2 \cdot \langle \Theta_{ZZ} \rangle$	$\mathrm{C\ m^2}$
electric field gradient tensor	$\boldsymbol{q}$	$q_{\alpha\beta} = -\partial^2 V/\partial\alpha\partial\beta$	$\mathrm{V\ m^{-2}}$
quadrupole interaction energy tensor	$\boldsymbol{\chi}$	$\chi_{\alpha\beta} = eQq_{\alpha\beta}$	J
electric polarizability of a molecule	α	p (induced) $= \alpha E$	$\mathrm{C\ m^2\ V^{-1}}$
activity (of a radioactive substance)	$\boldsymbol{A}$	$A = -\mathrm{d}N_\mathrm{B}/\mathrm{d}t$	Bq
decay (rate) constant, disintegration (rate) constant	λ	$A = \gamma N_\mathrm{B}$	$\mathrm{s^{-1}}$
half life	$t_{1/2}, T_{1/2}$		s
mean life	τ		s
level width	Γ	$\Gamma = \hbar/\tau$	J
disintegration energy	Q		J
cross section (of a nuclear reaction)	σ		$\mathrm{m^2}$
Spectroscopy			
total term	T	$T = E_\mathrm{tot}/hc$	$\mathrm{m^{-1}}$
transition wavenumber	$\tilde{\nu}, (\nu)$	$\tilde{\nu} = T' - T''$	$\mathrm{m^{-1}}$
transition frequency	ν	$\nu = (E' - E'')/h$	Hz
electronic term	T_e	$T_\mathrm{e} = E_\mathrm{e}/hc$	$\mathrm{m^{-1}}$
vibrational term	G	$G = E_\mathrm{vib}/hc$	$\mathrm{m^{-1}}$
rotational term	F	$F = E_\mathrm{rot}/hc$	$\mathrm{m^{-1}}$
spin orbit coupling constant	A	$T_\mathrm{s.o.} = A\langle \hat{\boldsymbol{L}} \cdot \hat{\mathbf{S}} \rangle$	$\mathrm{m^{-1}}$
principal moments of inertia	$I_A; I_B; I_C$	$I_A \leq I_B \leq I_C$	$\mathrm{kg\ m^2}$
rotational constants,			
in wavenumber	$\tilde{A}; \tilde{B}; \tilde{C}$	$\tilde{A} = h/8\pi^2 cI_A$	$\mathrm{m^{-1}}$
in frequency	$A; B; C$	$A = h/8\pi^2 I_A$	Hz
inertial defect	Δ	$\Delta = I_C - I_A - I_B$	$\mathrm{kg\ m^2}$
asymmetry parameter	κ	$\kappa = \dfrac{(2B - A - C)}{(A - C)}$	1
centrifugal distortion constants,			
S reduction	$D_J; D_{JK}; D_K; d_1; d_2$		$\mathrm{m^{-1}}$
A reduction	$\Delta_J; \Delta_{JK}; \Delta_K; \delta_J; \delta_K$		$\mathrm{m^{-1}}$
harmonic vibration wavenumber	$\omega_\mathrm{e}; \omega_r$		$\mathrm{m^{-1}}$
vibrational anharmonicity constant	$\omega_\mathrm{e} x_\mathrm{e}; x_{rs}; g_{u'}$		$\mathrm{m^{-1}}$
vibrational quantum numbers	$v_r; l_t$		1
Coriolis zeta constant	ζ_{rs}^{α}		1
angular momentum quantum numbers	see additional information below		
degeneracy, statistical weight	g, d, β		1
electric dipole moment of a molecule	$\boldsymbol{p}, \boldsymbol{\mu}$	$E_p = -\boldsymbol{p} \cdot \boldsymbol{E}$	C m
transition dipole moment of a molecule	$\boldsymbol{M}, \boldsymbol{R}$	$\boldsymbol{M} = \int \psi' \boldsymbol{p} \psi'' \mathrm{d}\tau$	C m
molecular geometry, interatomic distances,			
equilibrium distance	r_e		m
zero–point average distance	r_z		m

Name	Symbol	Definition	SI unit
ground state distance	r_0		m
substitution structure distance	r_s		m
vibrational coordinates,			
internal coordinates	R_i, r_i, θ_j, *etc.*		(varies)
symmetry coordinates	S_i		(varies)
normal coordinates			
mass adjusted	Q_r		$kg^{1/2}$ m
dimensionless	q_r		1
vibrational force constants,			
diatomic	$f, (k)$	$f = \partial^2 V/\partial r^2$	J m^{-2}
polyatomic,			
internal coordinates	f_{ij}	$f_{ij} = \partial^2 V/\partial r_i \partial r_j$	(varies)
symmetry coordinates	F_{ij}	$F_{ij} = \partial^2 V/\partial S_i \partial S_j$	(varies)
dimensionless normal coordinates	$\phi_{rst...}, k_{rst...}$		m^{-1}
nuclear magnetic resonance (NMR),			
magnetogyric ratio	γ	$\gamma = \mu/I\hbar$	C kg^{-1}
shielding constant	σ_A	$B_A = (1 - \sigma_A)B$	1
chemical shift, δ scale	δ	$\delta = 10^6(\nu - \nu_0)/\nu_0$	1
(indirect) spin–spin coupling constant	J_{AB}	$\hat{H}/h = J_{AB}\hat{I}_A \cdot \hat{I}_B$	Hz
direct (dipolar) coupling constant	D_{AB}		Hz
longitudinal relaxation time	T_1		s
transverse relaxation time	T_2		s
electron spin resonance, electron paramagnetic resonance (ESR, EPR),			
magnetogyric ratio	γ	$\gamma = \mu/s\hbar$	C kg^{-1}
g factor	g	$h\nu = g\mu_{\mathrm{B}}B$	1
hyperfine coupling constant,			
in liquids	a, A	$\hat{H}_{\mathrm{hfs}}/h = a\hat{S} \cdot \hat{I}$	Hz
in solids	T	$\hat{H}_{hfs}/h = \hat{S} \cdot T \cdot \hat{I}$	Hz

Angular momentum	Operator symbol	Quantum number symbol		
		Total	***Z*–axis**	***z*-axis**
electron orbital	$\hat{\boldsymbol{L}}$	L	M_L	Λ
one electron only	$\hat{l}$	l	m_l	λ
electron spin	$\hat{S}$	S	M_S	Σ
one electron only	$\hat{s}$	s	m_s	σ
electron orbital + spin	$\hat{\boldsymbol{L}} + \hat{S}$			$\Omega=\Lambda+\Sigma$
nuclear orbital (rotational)	$\hat{R}$	R		K_R, k_R
nuclear spin	$\hat{I}$	I	M_I	
internal vibrational				
spherical top	$\hat{l}$	$l(l\zeta)$		K_l
other	$\hat{j}, \hat{\pi}$			$l(l\zeta)$
sum of $R + L(+ j)$	$\hat{N}$	N		K, k
sum of $N + S$	$\hat{J}$	J	M_J	K, k
sum of $J + I$	$\hat{F}$	F	M_F	

Electromagnetic Radiation

Name	Symbol	Definition	SI unit
wavelength	λ		m
speed of light			
in vacuum	c_0		m s^{-1}
in a medium	c	$c = c_0/n$	m s^{-1}
wavenumber in vacuum	$\tilde{\nu}$	$\tilde{\nu} = \nu/c_0 = 1/n\lambda$	m^{-1}
wavenumber (in a medium)	σ	$\sigma = 1/\lambda$	m^{-1}
frequency	ν	$\nu = c/\lambda$	Hz
circular frequency, pulsatance	ω	$\omega = 2\pi\nu$	s^{-1}, rad s^{-1}
refractive index	n	$n = c_0/c$	1
Planck constant	h		J s

Name	Symbol	Definition	SI unit
Planck constant/2π	$\hbar$	$\hbar = h/2\pi$	J s
radiant energy	Q, W		J
radiant energy density	ρ, w	$\rho = Q/V$	J $\mathrm{m^{-3}}$
spectral radiant energy density			
in terms of frequency	ρ_ν, w_ν	$\rho = \mathrm{d}\rho/\mathrm{d}\nu$	J $\mathrm{m^{-3}\ Hz^{-1}}$
in terms of wavenumber	$\rho_{\tilde{\nu}}, w_{\tilde{\nu}}$	$\rho_{\bar{\nu}} = \mathrm{d}\rho/\mathrm{d}\bar{\nu}$	J $\mathrm{m^{-2}}$
in terms of wavelength	ρ_λ, w_λ	$\rho_\lambda = \mathrm{d}\rho/\mathrm{d}\lambda$	J $\mathrm{m^{-4}}$
Einstein transition probabilities			
spontaneous emission	A_{nm}	$\mathrm{d}N_n/\mathrm{d}t = -A_{nm}N_n$	$\mathrm{s^{-1}}$
stimulated emission	B_{nm}	$\mathrm{d}N_n/\mathrm{d}t = -\rho_{\tilde{\nu}}(\tilde{\nu}_{\mathrm{nm}}) \times B_{nm}N_n$	s $\mathrm{kg^{-1}}$
stimulated absorption	B_{mn}	$\mathrm{d}N_n/\mathrm{d}t = -\rho_{\tilde{\nu}}(\tilde{\nu}_{\mathrm{nm}})\ B_{mn}N_m$	s $\mathrm{kg^{-1}}$
radiant power, radiant energy per time	Φ, P	$\Phi = \mathrm{d}Q/\mathrm{d}t$	W
radiant intensity	I	$I = \mathrm{d}\Phi/\mathrm{d}\Omega$	W $\mathrm{sr^{-1}}$
radiant exitance (emitted radiant flux)	M	$M = \mathrm{d}\Phi/\mathrm{d}A_{\mathrm{source}}$	W $\mathrm{m^{-2}}$
irradiance, (radiant flux received)	$E, (I)$	$E = \mathrm{d}\Phi/\mathrm{d}A$	W $\mathrm{m^{-2}}$
emittance	ε	$\varepsilon = M/M_{\mathrm{bb}}$	1
Stefan–Boltzmann constant	σ	$M_{\mathrm{bb}} = \sigma T^4$	W $\mathrm{m^{-2}\ K^{-4}}$
first radiation constant	c_1	$c_1 = 2\pi hc_0^2$	W $\mathrm{m^2}$
second radiation constant	c_2	$c_2 = hc_0/k$	K m
transmittance, transmission factor	τ, T	$\tau = \Phi_{\mathrm{tr}}/\Phi_0$	1
absorptance, absorption factor	α	$\alpha = \Phi_{\mathrm{abs}}/\Phi_0$	1
reflectance, reflection factor	ρ	$\rho = \Phi_{\mathrm{refl}}/\Phi_0$	1
(decadic) absorbance	A	$A = -\lg(1 - \alpha_i)$	1
napierian absorbance	B	$B = -\ln(1 - \alpha_i)$	1
absorption coefficient			
(linear) decadic	a, K	$a = A/l$	$\mathrm{m^{-1}}$
(linear) napierian	α	$\alpha = B/l$	$\mathrm{m^{-1}}$
molar (decadic)	ε	$\varepsilon = a/c = A/cl$	$\mathrm{m^2\ mol^{-1}}$
molar napierian	κ	$\kappa = \alpha/c = B/cl$	$\mathrm{m^2\ mol^{-1}}$
absorption index	k	$k = \alpha/4\pi\tilde{\nu}$	1
complex refractive index	$\hat{n}$	$\hat{n} = n + \mathrm{i}k$	1
molar refraction	R, R_m	$R = \dfrac{(n^2-1)}{(n^2+2)}V_m$	$\mathrm{m^3\ mol^{-1}}$
angle of optical rotation	α		1, rad
Solid State			
lattice vector	$\boldsymbol{R}, \boldsymbol{R_0}$		m
fundamental translation vectors for the crystal lattice	$\boldsymbol{a_1}; \boldsymbol{a_2}; \boldsymbol{a_3}, \boldsymbol{a}; \boldsymbol{b}; \boldsymbol{c}$	$\boldsymbol{R} = n_1\boldsymbol{a_1} + n_2\boldsymbol{a_2} + n_3\boldsymbol{a_3}$	m
(circular) reciprocal lattice vector	$\boldsymbol{G}$	$\boldsymbol{G} \cdot \boldsymbol{R} = 2\pi m$	$\mathrm{m^{-1}}$
(circular) fundamental translation vectors for the reciprocal lattice	$\boldsymbol{b_1}; \boldsymbol{b_2}; \boldsymbol{b_3}, \boldsymbol{a^*}; \boldsymbol{b^*}; \boldsymbol{c^*}$	$\boldsymbol{a_i} \cdot \boldsymbol{b_k} = 2\pi\delta_{ik}$	$\mathrm{m^{-1}}$
lattice plane spacing	d		m
Bragg angle	θ	$n\lambda = 2d \sin\theta$	1, rad
order of reflection	n		1
order parameters			
short range	σ		1
long range	s		1
Burgers vector	$\boldsymbol{b}$		m
particle position vector	$\boldsymbol{r}, \boldsymbol{R_j}$		m
equilibrium position vector of an ion	$\boldsymbol{R_0}$		m
displacement vector of an ion	$\boldsymbol{u}$	$\boldsymbol{u} = \boldsymbol{R} - \boldsymbol{R_0}$	m
Debye–Waller factor	B, D		1
Debye circular wavenumber	q_D		$\mathrm{m^{-1}}$
Debye circular frequency	ω_D		$\mathrm{s^{-1}}$
Grüneisen parameter	γ, Γ	$\gamma = \alpha V/\kappa C_v$	1
Madelung constant	$\alpha, \mathcal{M}$	$E_{\mathrm{coul}} = \dfrac{\alpha N_{\mathrm{A}} z_+ z_- e^2}{4\pi\varepsilon_0 R_0}$	1
density of states	N_E	$N_E = \mathrm{d}N(E)/\mathrm{d}E$	$\mathrm{J^{-1}\ m^{-3}}$
(spectral) density of vibrational modes	N_ω, g	$N_\omega = \mathrm{d}N(\omega)/\mathrm{d}\omega$	s $\mathrm{m^{-3}}$

Name	Symbol	Definition	SI unit
resistivity tensor	ρ_{ik}	$\boldsymbol{E} = \boldsymbol{\rho} \cdot \boldsymbol{j}$	Ω m
conductivity tensor	σ_{ik}	$\sigma = \rho^{-1}$	$\mathrm{S\ m^{-1}}$
thermal conductivity tensor	λ_{ik}	$\boldsymbol{J}_q = -\boldsymbol{\lambda} \cdot \mathrm{grad}\ T$	$\mathrm{W\ m^{-1}\ K^{-1}}$
residual resistivity	ρ_R		Ω m
relaxation time	τ	$\tau = l/v_\mathrm{F}$	s
Lorenz coefficient	L	$L = \lambda/\sigma T$	$\mathrm{V^2\ K^{-2}}$
Hall coefficient	A_H, $\boldsymbol{R}_\mathrm{H}$	$\boldsymbol{E} = \boldsymbol{\rho} \cdot \boldsymbol{j} + R_\mathrm{H}(\boldsymbol{B} \times \boldsymbol{j})$	$\mathrm{m^3\ C^{-1}}$
thermoelectric force	E		V
Peltier coefficient	Π		V
Thomson coefficient	μ, (τ)		$\mathrm{V\ K^{-1}}$
work function	Φ	$\Phi = E_\infty - E_\mathrm{F}$	J
number density, number concentration	n, (p)		$\mathrm{m^{-3}}$
gap energy	E_g		J
donor ionization energy	E_d		J
acceptor ionization energy	E_a		J
Fermi energy	E_F, ε_F		J
circular wave vector, propagation vector	k, $\boldsymbol{q}$	$k = 2\pi/\lambda$	$\mathrm{m^{-1}}$
Bloch function	$u_k(\boldsymbol{r})$	$\psi(\boldsymbol{r}) = u_k(\boldsymbol{r}) \exp(\mathrm{i}\boldsymbol{k} \cdot \boldsymbol{r})$	$\mathrm{m^{-3/2}}$
charge density of electrons	ρ	$\rho(\boldsymbol{r}) = -e\psi^*(\boldsymbol{r})\psi(\boldsymbol{r})$	$\mathrm{C\ m^{-3}}$
effective mass	m^*		kg
mobility	μ	$\mu = v_\mathrm{drift}/E$	$\mathrm{m^2\ V^{-1}\ s^{-1}}$
mobility ratio	b	$b = \mu_\mathrm{n}/\mu_\mathrm{p}$	1
diffusion coefficient	D	$\mathrm{d}N/\mathrm{d}t = -DA(\mathrm{d}n/\mathrm{d}x)$	$\mathrm{m^2\ s^{-1}}$
diffusion length	L	$L = \sqrt{D\tau}$	m
characteristic (Weiss) temperature	θ, θ_w		K
Curie temperature	T_C		K
Néel temperature	T_N		K
Statistical Thermodynamics			
number of entities	N		1
number density of entities, number concentration	n, C	$n = N/V$	$\mathrm{m^{-3}}$
Avogadro constant	L, N_A		$\mathrm{mol^{-1}}$
Boltzmann constant	k, k_B		$\mathrm{J\ K^{-1}}$
gas constant (molar)	R	$R = Lk$	$\mathrm{J\ K^{-1}\ mol^{-1}}$
molecular position vector	$\boldsymbol{r}\,(x, y, z)$		m
molecular velocity vector	$\boldsymbol{c}(c_x, c_y, c_z)$, $\boldsymbol{u}(u_x, u_y, u_z)$	$\boldsymbol{c} = \mathrm{d}\boldsymbol{r}/\mathrm{d}t$	$\mathrm{m\ s^{-1}}$
molecular momentum vector	$\boldsymbol{p}(p_x, p_y, p_z)$	$\boldsymbol{p} = m\boldsymbol{c}$	$\mathrm{kg\ m\ s^{-1}}$
velocity distribution function (Maxwell)	$f(c_x)$	$f(c_x) = (m/2\pi kT)^{1/2} \times \exp(-mc_x^2/2kT)$	$\mathrm{m^{-1}\ s}$
speed distribution function (Maxwell–Boltzmann)	$F(c)$	$F(c) = (m/2\pi kT)^{3/2} \times 4\pi c^2 \exp(-mc^2/2kT)$	$\mathrm{m^{-1}\ s}$
average speed	$\bar{c}$, $\bar{u}$, $\langle c\rangle$, $\langle u\rangle$	$\bar{c} = \int cF(c)\mathrm{d}c$	$\mathrm{m\ s^{-1}}$
generalized coordinate	q		(m)
generalized momentum	p	$p = \partial L/\partial\dot{q}$	$(\mathrm{kg\ m\ s^{-1}})$
volume in phase space	Ω	$\Omega = (1/h)\int p\,\mathrm{d}q$	1
probability	P		1
statistical weight, degeneracy	g, d, W, ω, β		1
density of states	$\rho(E)$	$\rho(E) = \mathrm{d}N/\mathrm{d}E$	$\mathrm{J^{-1}}$
partition function, sum over states,			
for a single molecule	q, z	$q = \sum_i g_i \exp(-\varepsilon_i/kT)$	1
for a canonical ensemble (system, or assembly)	Q, Z		1
microcanonical ensemble	Ω		1
grand (canonical ensemble)	Ξ		1
symmetry number	σ, s		1
reciprocal temperature parameter	β	$\beta = 1/kT$	$\mathrm{J^{-1}}$
characteristic temperature	Θ		K

Name	Symbol	Definition	SI unit
General Chemistry			
number of entities (e.g. molecules, atoms, ions, formula units)	N		1
amount (of substance)	n	$n_B = N_B/L$	mol
Avogadro constant	L, N_A		mol^{-1}
mass of atom, atomic mass	m_a, m		kg
mass of entity (molecule, or formula unit)	m_f, m		kg
atomic mass constant	m_u	$m_u = m_a(^{12}C)/12$	kg
molar mass	M	$M_B = m/n_B$	$kg\ mol^{-1}$
relative molecular mass (relative molar mass, molecular weight)	M_r	$M_{r,B} = m_B/m_u$	1
molar volume	V_m	$V_{m,B} = V/n_B$	$m^3\ mol^{-1}$
mass fraction	w	$w_B = m_B/\Sigma m_i$	1
volume fraction	ϕ	$\phi_B = V_B/\Sigma V_i$	1
mole fraction, amount fraction, number fraction	x, y	$x_B = n_B/\Sigma n_i$	1
(total) pressure	p, P		Pa
partial pressure	p_B	$p_B = y_B p$	Pa
mass concentration (mass density)	γ, ρ	$\gamma_B = m_B/V$	$kg\ m^{-3}$
number concentration, number density of entities	C, n	$C_B = N_B/V$	m^{-3}
amount concentration, concentration	c	$c_B = n_B/V$	$mol\ m^{-3}$
solubility	s	$s_B = c_B$ (saturated solution)	$mol\ m^{-3}$
molality (of a solute)	$m, (b)$	$m_B = n_B/m_A$	$mol\ kg^{-1}$
surface concentration	Γ	$\Gamma_B = n_B/A$	$mol\ m^{-2}$
stoichiometric number	ν		1
extent of reaction, advancement	ξ	$\Delta\xi = \Delta n_B/\nu_B$	mol
degree of dissociation	α		1
Chemical Thermodynamics			
heat	q, Q		J
work	w, W		J
internal energy	U	$\Delta U = q + w$	J
enthalpy	H	$H = U + pV$	J
thermodynamic temperature	T		K
Celsius temperature	θ, t	$\theta/°C = T/K - 273.15$	°C
entropy	S	$dS \geq dq/T$	$J\ K^{-1}$
Helmholtz energy (Helmholtz function)	A	$A = U - TS$	J
Gibbs energy (Gibbs function)	G	$G = H - TS$	J
Massieu function	J	$J = -A/T$	$J\ K^{-1}$
Planck function	Y	$Y = -G/T$	$J\ K^{-1}$
surface tension	γ, σ	$\gamma = (\partial G/\partial A_s)_{T,p}$	$J\ m^{-2}, N\ m^{-1}$
molar quantity X	X_m	$X_m = X/n$	(varies)
specific quantity X	x	$x = X/m$	(varies)
pressure coefficient	β	$\beta = (\partial p/\partial T)v$	$Pa\ K^{-1}$
relative pressure coefficient	α_p	$\alpha_p = (1/p)(\partial p/\partial T)_V$	K^{-1}
compressibility,			
isothermal	κ_T	$\kappa_T = -(1/V)(\partial V/\partial p)_T$	Pa^{-1}
isentropic	κ_S	$\kappa_S = -(1/V)(\partial V/\partial p)_S$	Pa^{-1}
linear expansion coefficient	α_l	$\alpha_l = (1/l)(\partial l/\partial T)$	K^{-1}
cubic expansion coefficient	α, α_V, γ	$\alpha = (1/V)(\partial V/\partial T)_p$	K^{-1}
heat capacity,			
at constant pressure	C_p	$C_p = (\partial H/\partial T)_p$	$J\ K^{-1}$
at constant volume	C_V	$C_V = (\partial U/\partial T)_V$	$J\ K^{-1}$
ratio of heat capacities	$\gamma, (\kappa)$	$\gamma = C_p/C_V$	1
Joule–Thomson coefficient	μ, μ_{JT}	$\mu = (\partial T/\partial p)_H$	$K\ Pa^{-1}$
second virial coefficient	B	$pV_m = RT(1 + B/V_m + \ldots)$	$m^3\ mol^{-1}$
compression factor (compressibility factor)	Z	$Z = pV_m/RT$	1
partial molar quantity X	$X_B, (X'_B)$	$X_B = (\partial X/\partial n_B)_{T,p,n_{j \neq B}}$	(varies)
chemical potential (partial molar Gibbs energy)	μ	$\mu_B = (\partial G/\partial n_B)_{T,p,n_{j \neq B}}$	$J\ mol^{-1}$
absolute activity	λ	$\lambda_B = \exp(\mu_B/RT)$	1

Name	Symbol	Definition	SI unit
standard chemical potential	$\mu^{\ominus}, \mu^{o}$		J mol^{-1}
standard partial molar enthalpy	$H_{\mathrm{B}}^{\ominus}$	$H_{\mathrm{B}}^{\ominus} = \mu_{B}^{\ominus} + TS_{B}^{\ominus}$	J mol^{-1}
standard partial molar entropy	$S_{\mathrm{B}}^{\ominus}$	$S_{\mathrm{B}}^{\ominus} = -(\partial\mu_{B}^{\ominus}/\partial T)_{p}$	J mol^{-1} K^{-1}
standard reaction Gibbs energy (function)	$\Delta_{\mathrm{r}}G^{\ominus}$	$\Delta_{\mathrm{r}}G^{\ominus} = \sum_{\mathrm{B}} \nu_{\mathrm{B}}\mu_{\mathrm{B}}^{\ominus}$	J mol^{-1}
affinity of reaction	$A, (\mathcal{A})$	$A = -(\partial G/\partial\xi)_{p,T} = -\sum_{\mathrm{B}} \nu_{\mathrm{B}}\mu_{\mathrm{B}}$	J mol^{-1}
standard reaction enthalpy	$\Delta_{\mathrm{r}}H^{\ominus}$	$\Delta_{\mathrm{r}}H^{\ominus} = \sum_{\mathrm{B}} \nu_{\mathrm{B}}H_{\mathrm{B}}^{\ominus}$	J mol^{-1}
standard reaction entropy	$\Delta_{\mathrm{r}}S^{\ominus}$	$\Delta_{\mathrm{r}}S^{\ominus} = \sum_{\mathrm{B}} \nu_{\mathrm{B}}S_{\mathrm{B}}^{\ominus}$	J mol^{-1} K^{-1}
equilibrium constant	$K^{\ominus}, K$	$K^{\ominus} = \exp(-\Delta_{\mathrm{r}}G^{\ominus}/RT)$	1
equilibrium constant,			
pressure basis	K_p	$K_p = \prod_{\mathrm{B}} p_B{}^{\nu_{\mathrm{B}}}$	Pa$^{\Sigma\nu}$
concentration basis	K_c	$K_c = \prod_{\mathrm{B}} c_{\mathrm{B}}{}^{\nu_{\mathrm{B}}}$	(mol m^{-3})$^{\Sigma\nu}$
molality basis	K_m	$K_m = \prod_{\mathrm{B}} m_{\mathrm{B}}{}^{\nu_{\mathrm{B}}}$	(mol kg^{-1})$^{\Sigma\nu}$
fugacity	$f, \tilde{p}$	$f_{\mathrm{B}} = \lambda_{\mathrm{B}} \lim_{p\to 0}(p_{\mathrm{B}}/\lambda_{\mathrm{B}})_T$	Pa
fugacity coefficient	ϕ	$\phi_{\mathrm{B}} = f_{\mathrm{B}}/p_{\mathrm{B}}$	1
activity and activity coefficient referenced to Raoult's law, (relative) activity	a	$a_{\mathrm{B}} = \exp\left[\frac{\mu_{\mathrm{B}} - \mu_{\mathrm{B}}{}^{*}}{RT}\right]$	1
activity coefficient	f	$f_{\mathrm{B}} = a_{\mathrm{B}}/x_{\mathrm{B}}$	1
activities and activity coefficients referenced to Henry's law, (relative) activity,			
molality basis	a_m	$a_{m,\mathrm{B}} = \exp\left[\frac{\mu_{\mathrm{B}} - \mu_{\mathrm{B}}{}^{\ominus}}{RT}\right]$	1
concentration basis	a_c	$a_{c,\mathrm{B}} = \exp\left[\frac{\mu_{\mathrm{B}} - \mu_{\mathrm{B}}{}^{\ominus}}{RT}\right]$	1
mole fraction basis	a_x	$a_{x,\mathrm{B}} = \exp\left[\frac{\mu_{\mathrm{B}} - \mu_{\mathrm{B}}{}^{\ominus}}{RT}\right]$	1
activity coefficient,			
molality basis	γ_m	$a_{m,\mathrm{B}} = \gamma_{m,\mathrm{B}}m_{\mathrm{B}}/m^{\ominus}$	1
concentration basis	γ_c	$a_{c,\mathrm{B}} = \gamma_{c,\mathrm{B}}c_{\mathrm{B}}/c^{\ominus}$	1
mole fraction basis	γ_x	$a_{x,\mathrm{B}} = \gamma_{x,\mathrm{B}}x_{\mathrm{B}}$	1
ionic strength,			
molality basis	I_m, I	$I_m = ½\,\Sigma m_{\mathrm{B}}z_{\mathrm{B}}{}^2$	mol kg^{-1}
concentration basis	I_c, I	$I_c = ½\,\Sigma c_{\mathrm{B}}z_{\mathrm{B}}{}^2$	mol m^{-3}
osmotic coefficient,			
molality basis	ϕ_m	$\phi_m = (\mu_{\mathrm{A}}{}^{*} - \mu_{\mathrm{A}})/(RTM_{\mathrm{A}}\Sigma m_{\mathrm{B}})$	1
mole fraction basis	ϕ_x	$\phi_x = (\mu_{\mathrm{A}} - \mu_{\mathrm{A}}{}^{*})/(RT1nx_{\mathrm{A}})$	1
osmotic pressure	Π	$\Pi = c_{\mathrm{B}}RT$ (ideal dilute solution)	Pa

(i) Symbols used as subscripts to denote a chemical process or reaction

These symbols should be printed in roman (upright) type, without a full stop (period).

vaporization, evaporation (liquid → gas)	vap
sublimation (solid → gas)	sub
melting, fusion (solid → liquid)	fus
transition (between two phases)	trs
mixing of fluids	mix
solution (of solute in solvent)	sol
dilution (of a solution)	dil
adsorption	ads
displacement	dpl
immersion	imm

reaction in general	r
atomization	at
combustion reaction	c
formation reaction	f

(ii) Recommended superscripts

standard	$\ominus$, ^{o}
pure substance	$*$
infinite dilution	∞
ideal	id
activated complex, transition state	$\ddagger$
excess quantity	$^{\mathrm{E}}$

Name	**Symbol**	**Definition**	**SI unit**
Chemical Kinetics			
rate of change of quantity X	$\dot{X}$	$\dot{X} = \mathrm{d}X/\mathrm{d}t$	(varies)
rate of conversion	$\dot{\xi}$	$\dot{\xi} = \mathrm{d}\xi/\mathrm{d}t$	mol s^{-1}
rate of concentration change (due to chemical reaction)	r_B, v_B	$r_B = \mathrm{d}c_B/\mathrm{d}t$	mol $\mathrm{m}^{-3}\,\mathrm{s}^{-1}$
rate of reaction (based on amount concentration)	v	$v = \dot{\xi}/V = v_B^{-1}\mathrm{d}c_B/\mathrm{d}t$	mol $\mathrm{m}^{-3}\,\mathrm{s}^{-1}$
partial order of reaction	n_B	$v = k\Pi c_B^{n_B}$	1
overall order of reaction	n	$n = \Sigma n_B$	1
rate constant, rate coefficient	k	$v = k\Pi c_B^{n_B}$	$(\mathrm{mol}^{-1}\,\mathrm{m}^3)^{n-1}\,\mathrm{s}^{-1}$
Boltzmann constant	k, k_B		$\mathrm{J\,K}^{-1}$
half life	$t_{1/2}$	$c(t_{1/2}) = c_0/2$	s
relaxation time	τ	$\tau = 1/(k_1 + k_{-1})$	s
energy of activation, activation energy	E_a, E	$E_a = RT^2\,\mathrm{d}\ln k/\mathrm{d}T$	$\mathrm{J\,mol}^{-1}$
pre-exponential factor	A	$k = A\exp(-E_a/RT)$	$(\mathrm{mol}^{-1}\,\mathrm{m}^3)^{n-1}\,\mathrm{s}^{-1}$
volume of activation	$\Delta^{\ddagger}V$	$\Delta^{\ddagger}V = -RT \times (\partial \ln k/\partial p)_T$	$\mathrm{m}^3\,\mathrm{mol}^{-1}$
collision diameter	d	$d_{AB} = r_A + r_B$	m
collision cross-section	σ	$\sigma_{AB} = \pi d_{AB}^2$	m^2
collision frequency	Z_A		s^{-1}
collision number	Z_{AB}, Z_{AA}		$\mathrm{m}^{-3}\,\mathrm{s}^{-1}$
collision frequency factor	z_{AB}, z_{AA}	$z_{AB} = Z_{AB}/Lc_Ac_B$	$\mathrm{m}^3\,\mathrm{mol}^{-1}\,\mathrm{s}^{-1}$
standard enthalpy of activation	$\Delta^{\ddagger}H^{\ominus}, \Delta H^{\ddagger}$		$\mathrm{J\,mol}^{-1}$
standard entropy of activation	$\Delta^{\ddagger}S^{\ominus}, \Delta S^{\ddagger}$		$\mathrm{J\,mol}^{-1}\,\mathrm{K}^{-1}$
standard Gibbs energy of activation	$\Delta^{\ddagger}G^{\ominus}, \Delta G^{\ddagger}$		$\mathrm{J\,mol}^{-1}$
quantum yield, photochemical yield	ϕ		1
Electrochemistry			
elementary charge (proton charge)	e		C
Faraday constant	F	$F=eL$	$\mathrm{C\,mol}^{-1}$
charge number of an ion	z	$z_B = Q_B/e$	1
ionic strength	I_c, I	$I_c = \frac{1}{2}\Sigma c_i z_i^2$	$\mathrm{mol\,m}^{-3}$
mean ionic activity	$a_{\pm}$	$a_{\pm} = m_{\pm}\gamma_{\pm}/m^{\ominus}$	1
mean ionic molality	$m_{\pm}$	$m_{\pm}^{(\nu_+ + \nu_-)} = m_+^{\nu_+}m_-^{\nu_-}$	$\mathrm{mol\,kg}^{-1}$
mean ionic activity coefficient	$\gamma_{\pm}$	$\gamma_{\pm}^{(\nu_+ + \nu_-)} = \gamma_+^{\nu_+}\gamma_-^{\nu_-}$	1
charge number of electrochemical cell reaction	$n, (z)$		1
electric potential difference (of a galvanic cell)	$\Delta V, E, U$	$\Delta V = V_R - V_L$	V
emf, electromotive force	E	$E = \lim_{I \to 0} \Delta V$	V
standard emf, standard potential of the electrochemical cell reaction	$E^{\ominus}$	$E^{\ominus} = -\Delta_r G^{\ominus}/nF = (RT/nF)\ln K^{\ominus}$	V
standard electrode potential	$E^{\ominus}$		V
emf of the cell, potential of the electrochemical cell reaction	E	$E = E^{\ominus} - (RT/nF) \times \Sigma \nu_i \ln a_i$	V
pH	pH	$\mathrm{pH} \approx -\lg\left[\frac{c(\mathbf{H}^+)}{\mathrm{mol\,dm}^{-3}}\right]$	1
inner electric potential	ϕ	$\nabla\phi = -\boldsymbol{E}$	V
outer electric potential	ψ	$\psi = Q/4\pi\varepsilon_0 r$	V

Name	Symbol	Definition	SI unit
surface electric potential	χ	$\chi = \phi - \psi$	V
Galvani potential difference	$\Delta\phi$	$\Delta_\alpha^{\ \beta}\phi = \phi^\beta - \phi^\alpha$	V
volta potential difference	$\Delta\psi$	$\Delta_\alpha^{\ \beta}\psi = \psi^\beta - \psi^\alpha$	V
electrochemical potential	$\tilde{\mu}$	$\tilde{\mu}_B^{\ \alpha} = (\partial G/\partial n_B^{\ \alpha})$	J mol^{-1}
electric current	I	$I = \mathrm{d}Q/\mathrm{d}t$	A
(electric) current density	j	$j = I/A$	A m^{-2}
(surface) charge density	σ	$\sigma = Q/A$	C m^{-2}
electrode reaction rate constant	k	$\mathrm{k}_{\mathrm{ox}} = I_\mathrm{a}/(nFA\prod_i c_i^{n_i})$	(varies)
mass transfer coefficient, diffusion rate constant	k_d	$k_{\mathrm{d,B}} = \lvert\nu_B\rvert I_{\mathrm{I,B}}/nFcA$	m s^{-1}
thickness of diffusion layer	δ	$\delta_\mathrm{B} = D_\mathrm{B}/k_{\mathrm{d,B}}$	m
transfer coefficient (electrochemical)	α	$\alpha_c = \frac{-\lvert\nu\rvert RT\partial}{nF}\frac{\partial \ln \lvert I_c}{\partial E}$	1
overpotential	η	$\eta = E_I - E_{I=0} - IR_u$	V
electrokinetic potential (zeta potential)	ζ		V
conductivity	κ, (σ)	$\kappa = j/E$	S m^{-1}
conductivity cell constant	K_{cell}	$K_{\mathrm{cell}} = \kappa R$	m^{-1}
molar conductivity (of an electrolyte)	Λ	$\Lambda_\mathrm{B} = \kappa/c_\mathrm{B}$	S m^2 mol^{-1}
ionic conductivity, molar conductivity of an ion	λ	$\lambda_\mathrm{B} = \lvert z_\mathrm{B}\rvert Fu_\mathrm{B}$	S m^2 mol^{-1}
electric mobility	u, (μ)	$u_\mathrm{B} = \nu_\mathrm{B}/E$	m^2 V^{-1} s^{-1}
transport number	t	$t_\mathrm{B} = j_\mathrm{B}/\Sigma j_i$	1
reciprocal radius of ionic atmosphere	κ	$\kappa = (2F^2I/\varepsilon RT)^{1/2}$	m^{-1}
Colloid and Surface Chemistry			
specific surface area	a, a_s, s	$a = A/m$	m^2 kg^{-1}
surface amount of B, adsorbed amount of B	$n_\mathrm{B}^{\ \mathrm{s}}$, $n_\mathrm{B}^{\ \mathrm{a}}$		mol
surface excess of B	$n_\mathrm{B}^{\ \sigma}$		mol
surface excess concentration of B	Γ_B, $(\Gamma_\mathrm{B}^{\ \sigma})$	$\Gamma_\mathrm{B} = n_\mathrm{B}^{\ \sigma}/A$	mol m^{-2}
total surface excess concentration	Γ, (Γ^σ)	$\Gamma = \sum_i \Gamma_i$	mol m^{-2}
area per molecule	a, σ	$a_\mathrm{B} = A/N_\mathrm{B}^{\ \sigma}$	m^2
area per molecule in a filled monolayer	a_m, σ_m	$a_{\mathrm{m,B}} = A/N_{\mathrm{m,B}}$	m^2
surface coverage	θ	$\theta = N_\mathrm{B}^{\ \sigma}/N_{\mathrm{m,B}}$	1
contact angle	θ		1, rad
film thickness	t, h, δ		m
thickness of (surface or interfacial) layer	τ, δ, t		m
surface tension, interfacial tension	γ, σ	$\gamma = (\partial G/\partial A_\mathrm{s})_{T,p}$	N m^{-1}, J m^{-2}
film tension	Σ_f	$\Sigma_f = 2\gamma_\mathrm{f}$	N m^{-1}
reciprocal thickness of the double layer	κ	$\kappa = [2F^2I_c/\varepsilon RT]^{1/2}$	m^{-1}
average molar masses			
number–average	M_n	$M_n = \Sigma n_i M_i/\Sigma n_i$	kg mol^{-1}
mass–average	M_m	$M_m = \Sigma n_i M_i^2/\Sigma n_i M_i$	kg mol^{-1}
Z–average	M_Z	$M_Z = \Sigma n_i M_i^3/\Sigma n_i M_i^2$	kg mol^{-1}
sedimentation coefficient	s	$s = \nu/a$	s
van der Waals constant	λ		J
retarded van der Waals constant	β, B		J
van der Waals–Hamaker constant	A_H		J
surface pressure	π^s, π	$\pi^\mathrm{s} = \gamma^0 - \gamma$	N m^{-1}
Transport Properties			
flux (of a quantity X)	J_X, J	$J_X = A^{-1}\,\mathrm{d}X/\mathrm{d}t$	(varies)
volume flow rate	q_V, $\dot{V}$	$q_v = \mathrm{d}V/\mathrm{d}t$	m^3 s^{-1}
mass flow rate	q_m, $\dot{m}$	$q_m = \mathrm{d}m/\mathrm{d}t$	kg s^{-1}
mass transfer coefficient	k_d		m s^{-1}
heat flow rate	ϕ	$\phi = \mathrm{d}q/\mathrm{d}t$	W
heat flux	J_q	$J_q = \phi/A$	W m^{-2}
thermal conductance	G	$G = \phi/\Delta T$	W K^{-1}
thermal resistance	R	$R = 1/G$	K W^{-1}
thermal conductivity	λ, k	$\lambda = J_q/(\mathrm{d}T/\mathrm{d}l)$	W m^{-1} K^{-1}

Name	Symbol	Definition	SI unit
coefficient of heat transfer	$h, (k, K, \alpha)$	$h = J_q/\Delta T$	$\mathrm{W\ m^{-2}\ K^{-1}}$
thermal diffusivity	a	$a = \lambda/\rho c_p$	$\mathrm{m^2\ s^{-1}}$
diffusion coefficient	D	$D = J_n/(\mathrm{d}c/\mathrm{d}l)$	$\mathrm{m^2\ s^{-1}}$

The following symbols are used in the definitions of the dimensionless quantities: mass (m), time (t), volume (V), area (A), density (ρ), speed (v), length (l), viscosity (η), pressure (p), acceleration of free fall (g), cubic expansion coefficient (α), temperature (T), surface tension (γ), speed of sound (c), mean free path (λ), frequency (f), thermal diffusivity (a), coefficient of heat transfer (h), thermal conductivity (k), specific heat capacity at constant pressure (c_p), diffusion coefficient (D), mole fraction (x), mass transfer coefficient (k_d), permeability (μ), electric conductivity (κ), and magnetic flux density (B).

Name	Symbol	Definition	SI unit
Reynolds number	Re	$Re = pvl/\eta$	1
Euler number	Eu	$Eu = \Delta p/\rho v^2$	1
Froude number	Fr	$Fr = v/(lg)^{1/2}$	1
Grashof number	Gr	$Gr = l^3 g\alpha\Delta T\rho^2/\eta^2$	1
Weber number	We	$We = \rho v^2 l/\gamma$	1
Mach number	Ma	$Ma = v/c$	1
Knudsen number	Kn	$Kn = \lambda/l$	1
Strouhal number	Sr	$Sr = lf/v$	1
Fourier number	Fo	$Fo = at/l^2$	1
Péclet number	Pe	$Pe = vl/a$	1
Rayleigh number	Ra	$Ra = l^3 g\alpha\Delta T\rho/\eta a$	1
Nusselt number	Nu	$Nu = hl/k$	1
Stanton number	St	$St = h/\rho vc_p$	1
Fourier number for mass transfer	Fo^*	$Fo^* = Dt/l^2$	1
Péclet number for mass transfer	Pe^*	$Pe^* = vl/D$	1
Grashof number for mass transfer	Gr^*	$Gr^* = l^3 g\left(\frac{\partial p}{\partial x}\right)_{T,p}\left(\frac{\Delta xp}{\eta}\right)$	1
Nusselt number for mass transfer	Nu^*	$Nu^* = k_\mathrm{d}l/D$	1
Stanton number for mass transfer	St^*	$St^* = k_\mathrm{d}/v$	1
Prandtl number	Pr	$Pr = \eta/\rho a$	1
Schmidt number	Sc	$Sc = \eta/\rho D$	1
Lewis number	Le	$Le = a/D$	1
magnetic Reynolds number	Rm, Re_m	$Rm = v\mu\kappa l$	1
Alfvén number	Al	$Al = v(\rho\mu)^{1/2}/B$	1
Hartmann number	Ha	$Ha = Bl\,(\kappa/\eta)^{1/2}$	1
Cowling number	Co	$Co = B^2/\mu\rho v^2$	1