Appendix D

Glossary of Symbols

If no units are given, the quantity is either without units or has varying units.

Symbol	Meaning	S.I. units
α	Thermal expansion coefficient, or elongation	K^{-1}
α_L	Linear thermal expansion coefficient	K^{-1}
γ	Surface tension, or heat capacity ratio, or activity coefficient	$J\ m^{-2}$
Γ_i	Surface excess concentration	$mol\ m^{-2}$
δ	Infinitesimal amount of	
Δ	Change in a quantity	
ϵ	Molecular energy, or strain, or efficiency or coefficient of performance or Seebach coefficient	J $V\ K^{-1}$
ϵ_i	Energy of ith molecular state	J
ϵ_0	Permittivity of free space	$C^2\ s^2\ kg^{-1}\ m^{-3}$
$\epsilon_{r,A}$	Dielectric constant of solvent	
ξ	Extent of reaction	mol
θ	Contact angle	

(*continued*)

Symbol	Meaning	S.I. units
θ_f	Freezing-point depression	K
θ_b	Boiling-point elevation	K
ϑ	Fraction of surface sites occupied	
Θ	Volumetric rate of entropy generation	$J\ K^{-1}\ s^{-1}\ m^{-3}$
κ	Isothermal compressibility, or number of polymer chains in sample	Pa^{-1}
π	Surface pressure	$J\ m^{-2}$
Π	Osmotic pressure, or Peltier coefficient	Pa $J\ C^{-1}$
ρ	Density	$kg\ m^{-3}$
μ	Chemical potential	$J\ mol^{-1}$
$\tilde{\mu}$	Electrochemical potential	$J\ mol^{-1}$
μ_J	Joule coefficient	$K\ m^{-3}$
μ_{JT}	Joule–Thomson coefficient	$K\ Pa^{-1}$
ν	Number of chains per unit volume, or total number of ions produced in ionization	m^{-3}
ν_i	Stoichiometric coefficient of component i in a chemical reaction	
ν_+	Number of positive ions produced in ionization	
ν_-	Number of negative ions produced in ionization	
σ	Diameter of hard-sphere molecule, or surface area, or Thomson coefficient	m m^2 $J\ C^{-1}\ K^{-1}$
ϕ	Electrostatic potential, or fugacity coefficient, or osmotic coefficient	V
Φ	Dissipation	$J\ s^{-1}\ m^{-3}$
Ω	Number of configurations	
a	van der Waals gas constant, or linear term in stress–strain relation, or activity or the number of stoichiometric restrictions in a system, or the distance of closest approach of two ions	$N\ m^4\ mol^{-2}$ Pa m
a'	Berthelot gas constant	$N\ m^4\ K\ mol^{-2}$
a''	Redlich–Kwong gas constant	$N\ m^4\ K^{1/2}\ mol^{-2}$
A	Helmholtz free energy, or constant in Debye–Huckel equation	J
$\mathcal{A}$	Affinity of a chemical reaction	$J\ mol^{-1}$
b	van der Waals constant, or quadratic term in stress–strain relation	$m^3\ mol^{-1}$ Pa
b'	Berthelot gas constant	$m^3\ mol^{-1}$
b''	Redlich–Kwong gas constant	$m^3\ mol^{-1}$

Symbol	Meaning	S.I. units
B	Second virial coefficient, or constant in Debye–Huckel equation	$m^3\ mol^{-1}$
B'	Second virial coefficient	Pa^{-1}
c	Molecular speed, or number of component of a system	$m\ s^{-1}$
c_i	Molarity of component i	$mol\ L^{-1}$
c_V	Specific heat (at constant volume)	$J\ g^{-1}\ K^{-1}$
c_P	Specific heat (at constant pressure)	$J\ g^{-1}\ K^{-1}$
C_V	Heat capacity at constant volume	$J\ K^{-1}$
C_P	Heat capacity at constant pressure	$J\ K^{-1}$
d	Infinitesimal change of	
D_i	Diffusion coefficient of component i	$m^2\ s^{-1}$
E	Young's modulus, or	Pa
	total energy	J
$\mathscr{E}$	Cell potential	V
f	Fugacity, or	Pa
	number of degrees of freedom of a system	
f_i	Fraction of molecules in ith state	
$f(\nu_i)\ d\nu_i$	Fraction of molecules with component of velocity $\nu_i \leftrightarrow \nu_i + d\nu_i$	
$f(\epsilon)\ d\epsilon$	Fraction of molecules with energy $\epsilon \leftrightarrow \epsilon + d\epsilon$	
F	F Function	J
F_x	x Component of force	N
$F(c)\ dc$	Fraction of molecules with speeds $c \leftrightarrow c + dc$	
$\mathscr{F}$	Faraday's constant	$C\ mol^{-1}$
g_i	Degeneracy of states at ϵ_i	
G	Gibbs free energy	J
g	Acceleration due to gravity	$m\ s^{-2}$
H	Enthalpy	J
$\mathbf{H}$	Magnetic field	T
I_c	Ionic strength	$mol\ L^{-1}$
J_e	Flux of electric current	$C\ s^{-1}\ m^{-2}$
J_i	Flux of component i	$mol\ s^{-1}\ m^{-2}$
J_q	Heat flux	$J\ s^{-1}\ m^{-2}$
k	Boltzmann's constant	$J\ K^{-1}$
k_e	Electrical conductivity	$C\ s^{-1}\ m^{-1}\ V^{-1}$
k_q	Thermal conductivity	$J\ s^{-1}\ m^{-1}\ K^{-1}$
K	Kinetic energy, or	J
	equilibrium constant	
K_γ	Proper quotient of activity coefficients at equilibrium	
K_f	Freezing-point depression constant	$K\ kg\ mol^{-1}$
K_b	Boiling-point elevation constant	$K\ kg\ mol^{-1}$
K_{12}	Distribution coefficient between two solvents	

(*continued*)

Symbol	Meaning	S.I. units
$K_{m,i}$	Molality-based Henry's law constant	Pa kg mol^{-1}
l	Length (e.g., of a segment of a polymer chain), or generalized coordinate	m
i.s.	For an ideal solution	
id.s.	For an ideally dilute solution	
L	Length, or generalized force	m
L_D	Debye length	m
L_{ij}	Proportionality constant between flow i and force j	
m	Mass of a molecule	kg
m_i	Molality of component i	mol kg^{-1}
M	Molar mass, or	kg mol^{-1}
	mass of an object	kg
n	Number of moles	mol
N_A	Avogadro's number	molecules mol^{-1}
N_i	Number of molecules in the ith state	
p	Number of coexisting phases in a system	
P	Pressure	Pa
P_c	Critical pressure	Pa
P_i	Partial pressure of component i	Pa
$P(r, N)\, dr$	Probability that a polymer chain of N segments has length $r \leftrightarrow r + dr$	
q	Heat, or molecular partition function	J
Q	Electric charge, or system partition function	C
Q_a	Proper coefficient of activity coefficients for a chemical reaction	
Q^*	Energy of transport	J mol^{-1}
r	Length of a polymer chain, or	m
	radius of curvature, or	m
	the number of independent reactions in a system	
R	Gas constant, or	J mol^{-1} K^{-1}
	radius of a tube	m
S	Entropy	J K^{-1}
t	Temperature, or	°C
	time	s
T	Temperature	K
T_B	Boyle temperature	K
T_c	Critical temperature	K
T_r	Reduced temperature	
U	Internal energy	J
v	Amount adsorbed on a adsorbate	cm^3

Symbol	Meaning	S.I. units
v_x	x Component of velocity	m s^{-1}
v_{react}	Volumetric rate of reaction	mol s^{-1} m^{-3}
V	Volume, or	m^3
	potential energy	J
V_c	Critical volume	m^3
$V_{m,r}$	Reduced molar volume	
x_i	Mole fraction of component i	
X	General thermodynamic variable	
$\bar{X}$	Partial molar thermodynamic variable	
X^E	Excess thermodynamic variable	
y_i	Mole fraction of component i in vapor above a solution	
z_i	Overall mole fraction of component i in system, or charge on an ion	
Z	Compression factor	
$\langle\ \rangle$	Average over molecules	
∇	Gradient of a scalar function	

Subscripts

ϕ	For a phase change
A	Of solvent
bd	For bond dissociation
c	Cold Reservoir
cycle	For a cyclic process
e	At equilibrium
elec	In an electrical process
exp	For expansion
ext	External
f	Of formation
fus	Fusion (melting)
gas	Of gas
h	Hot reservoir
im	For immersion
ind	Independent
int	Internal
liq	For liquid
m	Per mole
mech	In a mechanical process
melt	For melting
mix	For mixing
oth	Other (besides expansion)
rxn, react	For a chemical reaction

(*continued*)

Symbol	Meaning	S.I. units
rev	For a reversible process	
rot	Rotational	
solid	For solid	
sub	Sublimation	
sur	Of the surroundings	
surf	Of a surface	
tot	Total	
tr	Translational	
trans	For transfer between solvents	
univ	For the universe	
vap	Vaporization, or for vapor	
vib	Vibrational	
+	For positive ion	
−	For negative ion	
±	Mean ionic	
Superscripts		
σ	Surface thermodynamic function	
°	In the standard state	
*	Of a pure substance	
rel	Solute relative to solvent	