SYMBOLS FOR THERMODYNAMICAL AND PHYSICO-CHEMICAL QUANTITIES AND CONVENTIONS RELATING TO THEIR USE, ADOPTED AS RECOMMENDED PRACTICE BY THE CHEMICAL SOCIETY.

(*Where two or more symbols separated by commas or semicolons are given for a quantity, these symbols are to be regarded as alternatives for which no preference is expressed. On the other hand, where two symbols are separated by a dotted line, the former is the first preference.*)

1. To be Printed in Black Italic.

(*Certain important physical constants.*)

F	Faraday's constant.
J	Mechanical equivalent of heat.
N	Avogadro's number.
R	Gas constant per mol. Rydberg's constant.
c	Velocity of light in vacuo.
e	Electronic charge (charge equal and opposite in sign to that of an electron).
g	Acceleration due to gravity (standard value, if variation from standard is significant).
h	Planck's constant.
k	Boltzmann's constant.
m	Rest mass of an electron.

2. To be Printed in Ordinary Italic, when not Greek.

General Physics and Chemistry.

Length	l
mean free path of molecules	l
height	h
diameter, distance	d
diameter of molecules	σ
radius	r
Mass	m
molecular weight	M
atomic weight	A
atomic number	Z
gram-equivalent weight	Z, J
Time	t
time interval, especially half- or mean-life	τ
frequency	ν
Velocity	v; c, (u, v, w)
of ions	u (with subscript)
angular	ω
Acceleration	f . . . a
due to gravity (as variable)	g
Force	F, (X, Y, Z)
Moment of inertia	I
Pressure	p, P
especially osmotic	Π
Volume	v, V
Density	ρ . . . d
Compressibility	κ . . . K

Viscosity	η
Fluidity	ϕ
Surface area	$A \ldots s$
Angle of contact	θ
Surface tension	$\gamma \ldots \sigma$
Parachor	$[P]$
Surface concentration excess	Γ
Number of mols	n
Concentration, mol fraction	N, x
in other terms	c, C
Solubility	s
Diffusion coefficient	D
Chemical equilibrium constant (products/reactants)	K
solubility product	$K_s \ldots L$
Velocity constant of chemical reaction	k
Number of molecular collisions per second	Z
Partition function	f
Efficiency, of any process	η
Wave function	ψ

Heat and Thermodynamics.

Temperature, on absolute scale, (°K)	T
on other scales	$\theta \ldots t$
Thermal conductivity	k
Energy (general symbol)	E
Work done by or on a system	$w \ldots W$
Heat entering a system	q
Specific heat	c_p and c_v
molecular heat	C_p and C
Ratio of specific heats	γ
Latent heat, per g.	l
per mol	L
Intrinsic energy	$U \ldots E$
Enthalpy, total heat, or heat content	H
Entropy	S
Free energy (Helmholtz)	$A \ldots F$
Thermodynamic potential, Gibbs function, free energy (G. N. Lewis)	G
Vapour pressure constant	$\imath$
Chemical potential	μ
Activity	a
coefficient (for molar concentration)	f
Osmotic coefficient	g
Van 't Hoff's factor	$\imath$

Electricity.

Quantity of electricity	Q
especially electrostatic charge	e
Potential (difference)	V
Volta potential	V
electrokinetic potential	ζ
especially electromotive force of voltaic cells	E
Potential gradient, in electric field	X
Electronic exit work function	ϕ

Current	I
Resistance	R
specific resistance	ρ . . . r
specific conductance	κ . . . σ
Inductance, self	L
mutual	M
Electrostatic capacity	C
Dielectric constant	ϵ
Dipole moment	μ

Electrochemistry.

Degree of electrolytic dissociation	α
Valency of an ion	z
Ionic strength	I
Equivalent conductance	Λ
equivalent ionic conductance, "mobility"	l (with subscript)
Transport number	T (with subscript) . . . n (with subscript)
Single electrode potential	e (with subscript), E (with subscript)
Electrolytic polarisation, overvoltage	η . . . π

Magnetism.

Magnetic field strength	H
flux	ϕ
permeability	μ
susceptibility—volume	κ
mass	χ
moment	M
induction	B

Optics.

Wave length	λ
Wave number	ν
Intensity of light	I
Refractive index	n (with subscript) . . . μ (with subscript)
specific refraction	r (with subscript)
molecular refraction	$[R]$ (with subscript)
Molar extinction coefficient	ϵ
Angle of (optical) rotation	α
specific rotation	$[\alpha]$
Specific magnetic rotation	ω

3. To be Printed in Roman, when not Greek.

(a) *Examples of Mathematical Constants and Operators.*

Base of natural logarithms	e
Ratio of circumference to diameter	$\mathrm{\pi}$
Differential	d
partial	∂
Increment	Δ
very small increment	δ
Sum	Σ
Product	Π
Function	f, ϕ

(b) *Examples of single-letter abbreviations.*

*Ampère (in sub-units)	a.
Volt	v.
Ohm	Ω.
Watt	w.
Farad	F.
Henry	H.
Centigrade	C.
Fahrenheit	F.
Kelvin	K.
Ångstrom unit	A.
micron	μ.
metre	m.
gram	g.
litre	l.
Röntgen unit	r.
†Normal (concentration)	N.
†Molar (concentration)	M.

The following prefixes to abbreviations for the names of units should be used to indicate the specified multiples or sub-multiples of these units:

M	mega-	$10^6 \times$
k	kilo-	$10^3 \times$
d	deci-	$10^{-1} \times$
c	centi-	$10^{-2} \times$
m	milli-	$10^{-3} \times$
μ	micro-	$10^{-6} \times$

e.g., MΩ. denotes megohm; kw., kilowatt; and μg., microgram. The use of μμ. instead of mμ. to denote 10^{-7} cm., or of γ to denote microgram is deprecated.

4. Subscripts and other Modifying Signs.

(a) *Subscripts to symbols for quantities.*

I, II . . . 1, 2 . . .	*especially with symbols for thermodynamic functions*, referring to different systems or different states of a system.
A B .	referring to molecular species A, B, etc.
i	referring to a typical ionic species i.
u	referring to an undissociated molecule.
+, −	referring to a positive or negative ion, or to a positive or negative electrode.
p, *v*, *T*	indicating constant pressure, volume, and temperature respectively.
q	indicating adiabatic conditions.
w	indicating that no work is performed.
p, *c*, *a*	*with symbol for an equilibrium constant*, indicating that it is expressed in terms of pressure, concentration, or activity.
G, V, L, X	referring to gas, vapour, liquid, and crystalline states, respectively.
f, e, s, t, d	referring to fusion, evaporation (vaporisation of liquid), sublimation, transition, and dissolution or dilution respectively.
c	referring to the critical state or indicating a critical value.
0	referring to a standard state, or indicating limiting value at infinite dilution.

* *E.g.* "ma." for "milliampère"; but "amp." is preferred for "ampère."

† Separated by a hyphen (and no full stop) from a chemical formula which follows it.

C, D, F — *with symbols for optical properties,* referring to a particular wavelength.

Where a subscript has to be added to a symbol which already carries a subscript, the two subscripts may be separated by a comma or the symbol with the first subscript may be enclosed in parentheses with the second subscript outside.

(b) *Other modifying signs.*

o	*as right-hand superscript to symbol (particularly to a symbol for a general thermodynamic function—see p. 5),* referring to a standard state.
[ ]	*enclosing formula of chemical substance,* indicating its molar concentration.
{ }	*enclosing formula of chemical substance,* indicating its molar activity.

In crystallography it is recommended that:

Millerian indices be enclosed in parentheses, ( );
Laue indices be unenclosed;
Indices of a plane family be enclosed in braces, { };
Indices of a zone axis or line be enclosed in brackets, [ ].

Numerals attached to a symbol for a chemical element in various positions have the following meanings:

upper left	mass number of atom.
lower left	nuclear charge of atom.
lower right	number of atoms in molecule.

e.g., ${}^{7}_{3}Li$; ${}^{2}_{1}H_2$ ($= D_2$).

ALPHABETICAL INDEX OF RECOMMENDED SYMBOLS, and single-letter abbreviations.

including all those given in the above lists except prefixes, subscripts and other modifying signs.

The name of any quantity for which a given symbol is a second preference is printed in parentheses.

A	free energy—Helmholtz; atomic weight; surface area.
A.	Ångstrom unit.
a	activity; (acceleration).
a.	ampère, in sub-units—see footnote, p. 2093.
B	magnetic induction.
C	concentration; electrostatic capacity.
	with subscript: molecular heat capacity.
C.	Centigrade.
c	velocity of light in vacuo.
c	velocity; concentration.
	with subscript: specific heat.
D	diffusion coefficient.
d	diameter; distance; (density).
d	differential.
∂	partial differential.
E	energy; (intrinsic energy); potential difference, especially electromotive force of voltaic cells.
	with subscript: single electrode potential.
e	electronic charge—charge equal and opposite in sign to that of an electron.
e	quantity of electricity, especially electrostatic charge.
	with subscript: single electrode potential.

e	base of natural logarithms.
$\boldsymbol{F}$	Faraday's constant.
F	force; (free energy—Helmholtz).
F.	farad; Fahrenheit.
f	acceleration; activity coefficient, for molar concentration; partition function.
f	function.
G	thermodynamic potential, Gibbs function, free energy—G. N. Lewis.
$\boldsymbol{g}$	acceleration due to gravity, standard value.
g	acceleration due to gravity, as a variable; osmotic coefficient.
g.	gram.
H	enthalpy, total heat, heat content; magnetic field strength.
H.	henry.
$\boldsymbol{h}$	Planck's constant.
h	height.
I	moment of inertia; ionic strength; electric current; intensity of light.
i	vapour pressure constant; van 't Hoff's factor.
$\boldsymbol{J}$	mechanical equivalent of heat.
J	gram-equivalent weight.
K	chemical equilibrium constant; (compressibility).
	K_s solubility product.
K.	Kelvin.
$\boldsymbol{k}$	Boltzmann's constant.
k	thermal conductivity; velocity constant of chemical reaction.
L	latent heat per mol; self inductance; (solubility product).
l	latent heat per g.; length; mean free path of molecules.
	with subscript: equivalent ionic conductance, " mobility "
l.	litre.
M	molecular weight; mutual inductance; magnetic moment.
M.	molar concentration.
$\boldsymbol{m}$	rest mass of an electron.
m	mass.
m.	metre.
$\boldsymbol{N}$	Avogadro's number.
N	mol fraction.
N.	normal concentration.
n	number of mols.
	with subscript: (transport number).
	with subscript: refractive index.
P	pressure.
$[P]$	parachor.
p	pressure.
Q	quantity of electricity.
q	heat entering a system.
$\boldsymbol{R}$	gas constant per mol; Rydberg's constant.
R	electrical resistance.
$[R]$	*with subscript:* molecular refraction.
r	radius; (specific resistance).
	with subscript: specific refraction.
r.	Röntgen unit.
S	entropy.
s	solubility; (surface area).
T	temperature, on absolute Kelvin scale.
	with subscript: transport number.
t	time; (temperature—not on absolute scale).
U	intrinsic energy.
u	velocity component.
	with subscript: velocity of ions.
V	volume; potential, potential difference, including Volta potential.

v. volt.
v volume; velocity; velocity component.
W (work done by or on a system).
w. watt.
w work done by or on a system; velocity component.
X force component; potential gradient in electric field.
x mol fraction.
Y force component.
Z force component; g.-equivalent weight; number of molecular collisions per second; atomic number.
z valency of an ion.

α degree of electrolytic dissociation; angle of optical rotation.
$[\alpha]$ specific optical rotation.
Γ surface concentration excess.
γ ratio of specific heats; surface tension.
Δ increment.
δ very small increment.
ϵ dielectric constant; molar extinction coefficient.
ζ electrokinetic potential.
η efficiency of any process; viscosity; electrolytic polarisation, overvoltage.
θ angle of contact; temperature—not on absolute scale.
κ compressibility; specific conductance; magnetic susceptibility—volume.
Λ equivalent conductance.
λ wave length.
μ chemical potential; dipole moment; magnetic permeability.
with subscript: (refractive index).
μ. micron.
ν frequency; wave number.
Π pressure, especially osmotic pressure.
Π product.
π (electrolytic polarisation, overvoltage).
π ratio of circumference to diameter.
ρ density; specific resistance.
Σ sum.
σ diameter of molecules; (surface tension); (specific conductance).
τ time interval, especially half or mean life.
ϕ fluidity; electronic exit work function; magnetic flux.
φ function.
χ magnetic susceptibility—mass.
ψ wave function.
Ω. ohm.
ω angular velocity; specific magnetic rotation.