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Quantities and units —

Part 9: Physical chemistry and molecular physics

Grandeurs et unités —

Partie 9: Chimie physique et physique moléculaire

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www. iso. org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www. iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www. iso .org/iso/foreword. html.

This document was prepared by Technical Committee ISO/TC 12, *Quantities and units*, in collaboration with Technical Committee IEC/TC 25, *Quantities and units*.

This second edition cancels and replaces the first edition (ISO 80000-9:2009), which has been technically revised. It also incorporates the Amendment ISO 80000-9:2009/Amd. 1:2011.

The main changes compared to the previous edition are as follows:

— the table giving the quantities and units has been simplified;

— some definitions and the remarks have been stated physically more precisely.

A list of all parts in the ISO 80000 and IEC 80000 series can be found on the ISO and IEC websites.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

In this document, symbols for substances are shown as subscripts, for example c_B, w_B, p_B for substance B.

Generally, it is advisable to put symbols for substances and their states in parentheses on the same line as the main symbol, for example $c(H_2SO_4)$.

In the following, the letter s is used to denote the solid state, the letter l the liquid state, and the letter g the gaseous state.

The symbol * used as a superscript means "pure".

The plimsoll sign $^{\ominus}$ is used to denote a standard in general.

EXAMPLE 1 $\mu_B^*(T,p)$ for chemical potential of pure substance B concerning a mixture system including the substance B.

EXAMPLE 2 $C_{m,p}^{\ominus}(H_2O, g, 298{,}15\ K) = 33{,}58\ J \cdot K^{-1} \cdot mol^{-1}$ for standard molar heat capacity at constant pressure.

In an expression such as

$$\varphi_B = x_B \frac{V_{m,B}}{\sum x_i V_{m,i}}$$

where

φ_B is the volume fraction of a particular substance B in a mixture of substances A, B, C, ...;

x_i is the amount-of-substance fraction of i; and

$V_{m,i}$ is the molar volume of the pure substance i, where all the molar volumes $V_{m,A}$, $V_{m,B}$, $V_{m,C}$, ... are taken at the same temperature and pressure,

the summation on the right-hand side is that over all the substances A, B, C, ... of which a mixture is composed, so that $\sum x_i = 1$. Throughout the document sums are running over the respective index.

Additional qualifying information on a quantity symbol may be added as a subscript or superscript (see e.g. item 9-21) or in parentheses after the symbol.

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Quantities and units —

Part 9:
Physical chemistry and molecular physics

1 Scope

This document gives names, symbols, definitions and units for quantities of physical chemistry and molecular physics. Where appropriate, conversion factors are also given.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

Names, symbols, definitions and units for quantities used in physical chemistry and molecular physics are given in Table 1.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

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Table 1 — Quantities and units used in physical chemistry and molecular physics

Item No.	Quantity			Unit	Remarks
	Name	Symbol	Definition		
9-1	number of entities	$N(\mathrm{X})$, N_{X}	number of elementary entities of kind X in a system	1	The elementary entities must be specified and can be atoms, molecules, ions, electrons, other particle, or a specified group of such particles. It is important to always give a precise specification of the entity involved; this should preferably be done by the empirical chemical formula of the material involved.
9-2	amount of substance DEPRECATED: number of moles	$n(\mathrm{X})$	quotient of number N of specified elementary entities of kind X (item 9-1) in a sample, and the Avogadro constant N_{A} (ISO 80000-1): $n(\mathrm{X})=N(\mathrm{X})/N_{\mathrm{A}}$	mol	Amount of substance is one of the seven base quantities in the International System of Quantities, ISQ (see ISO 80000-1). Elementary entities, such as molecules, atoms, ions, electrons, holes and other quasi-particles, double bonds can be used. It is necessary to specify precisely the entity involved, e.g. atoms of hydrogen H vs. molecules of hydrogen H_2, preferably by giving the molecular chemical formula of the material involved. In the name “amount of substance”, the words “of substance” could be replaced by words specifying the substance concerned, e.g. “amount of hydrogen chloride, HCl”, or “amount of benzene, C_6H_6”. The name “number of moles” is often used for “amount of substance”, but this is deprecated because the name of a quantity should be distinguished from the name of the unit.

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