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Second edition  
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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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ISO copyright office  
CP 401 • Ch. de Blandonnet 8  
CH-1214 Vernier, Geneva  
Phone: +41 22 749 01 11  
Fax: +41 22 749 09 47  
Email: [copyright@iso.org](mailto:copyright@iso.org)  
Website: [www.iso.org](http://www.iso.org)

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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](http://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](http://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](http://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](http://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  $c(\text{H}_2\text{SO}_4)$ .

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  $C_{m,p}^\ominus(\text{H}_2\text{O}, \text{g}, 298,15 \text{ K})=33,58 \text{ J}\cdot\text{K}^{-1}\cdot\text{mol}^{-1}$  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

$\varphi_B$  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  $V_{m,A}, V_{m,B}, V_{m,C}, \dots$  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.