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Veličine in enote - 9. del: Fizikalna kemija in molekulska fizika (ISO/DIS 80000-9:2017)

Quantities and units - Part 9: Physical chemistry and molecular physics (ISO/DIS 80000-9:2017)

Größen und Einheiten - Teil 9: Physikalische Chemie und Molekularphysik (ISO/DIS 80000-9:2017)

Grandeurs et unités - Partie 9: Chimie physique et physique moléculaire (ISO/DIS 80000-9:2017)

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Part 9:
Physical chemistry and molecular physics

Grandeurs et unités —

Partie 9: Chimie physique et physique moléculaire

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Contents

Page

Foreword ..... **iv**
Introduction ..... **vi**
1 Scope **1**
2 Normative references **1**
3 Names, symbols, and definitions **1**
4 Quantities, units and definitions **0**
Annex A (normative) pH **0**
Bibliography **2**

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 on 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 the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 12, *Quantities and units*

This third edition cancels and replaces the second edition (2013), of which has been technically revised.

ISO 80000 consists of the following parts.

— *Part 1: General*

— *Part 2: Mathematics*

— *Part 3: Space and time*

— *Part 4: Mechanics*

— *Part 5: Thermodynamics*

— *Part 7: Light and radiation*

— *Part 8: Acoustics*

— *Part 9: Physical chemistry and molecular physics*

— *Part 10: Atomic and nuclear physics*

— *Part 11: Characteristic numbers*

— *Part 12: Condensed matter physics*

IEC 80000 consists of the following parts, under the general title *Quantities and units*:

— *Part 6: Electromagnetism*

— *Part 13: Information science and technology*

— *Part 14: Telebiometrics related to human physiology*[1]

[1] being replaced by ISO/IEC 80003 series

Introduction

0.1 Arrangements of the tables

The tables of quantities and units in this International Standard are arranged so that the quantities and the units are presented on the same page.

All units between two full lines on the right-hand pages belong to the quantities between the corresponding full lines on the left-hand pages.

Where the numbering of an item has been changed in the revision of a part of last edition, the number in the preceding edition is shown in parentheses on the left-hand page under the new number for the quantity; a dash is used to indicate that the item in question did not appear in the preceding edition.

0.2 Quantities

The names in English and in French of the most important quantities within the field of this International Standard are given together with their symbols and, in most cases, their definitions. These names and symbols are recommendations. The definitions are given for identification of the quantities in the International System of Quantities (ISQ), listed on the left-hand pages of the table; they are not intended to be complete.

The scalar, vectorial or tensorial character of quantities is pointed out using symbols with arrows like $\vec{v}$, $\vec{\vec{T}}$ or subscripts like v_i T_{ij} especially when this is needed for the definitions.

In most cases only one name and only one symbol for the quantity are given; where two or more names or two or more symbols are given for one quantity and no special distinction is made, they are on an equal footing. When two types of italic letters exist (for example as with θ and ϑ; φ and ϕ; a and a; g and g; κ and $\varkappa$) only one of these is given. This does not mean that the other is not equally acceptable. It is recommended that such variants should not be given different meanings. A symbol within parentheses implies that it is a reserve symbol, to be used when, in a particular context, the main symbol is in use with a different meaning.

In this English edition, the quantity names in French are printed in an italic font, and are preceded by *fr*. The gender of the French name is indicated by (m) for masculine and (f) for feminine, immediately after the noun in the French name.

0.3 Units

0.3.1 General

The names of units and their definitions are given in Part 1, General. Unit names are language-dependent, but the symbols are international and the same in all languages. For further information, see the SI Brochure (8th edition 2006) from BIPM and ISO 80000-1.

0.3.2 Remark on units for quantities of dimension one, or dimensionless quantities

The coherent unit for any quantity of dimension one, also called a dimensionless quantity, is the number one, symbol 1. When the value of such a quantity is expressed, the unit symbol 1 is generally not written out explicitly.

EXAMPLE 1 Refractive index $n = 1{,}53 \times 1 = 1{,}53$

Prefixes shall not be used to form multiples or submultiples of this unit. Instead of prefixes, powers of 10 are recommended.

EXAMPLE 2 Reynolds number $Re = 1{,}32 \times 10^3$

Considering that plane angle is generally expressed as the ratio of two lengths and solid angle as the ratio of two areas, in 1995 the CGPM specified that, in the SI, the radian, symbol rad, and steradian, symbol sr, are dimensionless derived units. This implies that the quantities plane angle and solid angle are considered as derived quantities of dimension one. The units radian and steradian are thus equal to one; they may either be omitted, or they may be used in expressions for derived units to facilitate distinction between quantities of different kinds but having the same dimension.

0.4 Numerical statements in this International Standard

The sign $=$ is used to denote "is exactly equal to", the sign $\approx$ is used to denote "is approximately equal to", and the sign $:=$ is used to denote "is by definition equal to".

Numerical values of physical quantities that have been experimentally determined always have an associated measurement uncertainty. This uncertainty should always be specified. In this International Standard, the magnitude of the uncertainty is represented as in the following example.

EXAMPLE $l = 2{,}347\,82(32)$ m

In this example, $l = a(b)$ m, the numerical value of the uncertainty b indicated in parentheses is assumed to apply to the last (and least significant) digits of the numerical value a of the length l. This notation is used when b represents one standard uncertainty (estimated standard deviation) in the last digits of a. The numerical example given above may be interpreted to mean that the best estimate of the numerical value of the length l (when l is expressed in the unit metre) is $2{,}347\,82(32)$ and that any value of l between $2{,}347\,82 - 0{,}000\,32$ m and $2{,}347\,82 - 0{,}000\,32$ m with a probability determined by the standard uncertainty 0,000 32 m and the probability distribution of the values of l can be attributed to the measurand (see JCGM 100:2008, Annex D).

0.5 Special remarks

In this part of ISO 80000, 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 $c(\mathrm{H_2SO_4})$.

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 superscript $*$ is used to mean "pure". The superscript $^\circ$ is used to mean "standard".

The plimsoll sign $\ominus$ is used to denote a standard in general. The degree sign ° can also be used for this.

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

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

In an expression such as $\varphi_{\mathrm{B}} = x_{\mathrm{B}} \frac{V_{\mathrm{m,\,B}}}{\sum x_i} V_{\mathrm{m},i}$, where φ_{B} denotes the volume fraction of a particular substance B in a mixture of substances A, B, C, ..., where x_i denotes the amount-of-substance fraction of i and $V_{\mathrm{m},i}$ the molar volume of the pure substance i, and where all the molar volumes $V_{\mathrm{m,A}}$, $V_{\mathrm{m,B}}$, $V_{\mathrm{m,C}}$, ... 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 (item 9-21) or in parentheses after the symbol.

Quantities and units — Part 9: Physical chemistry and molecular physics

1 Scope

ISO 80000-9 gives names, symbols, and definitions for quantities and units of physical chemistry and molecular physics. Where appropriate, conversion factors are also given.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 80000-3:2006, *Quantities and units — Part 3: Space and time*

ISO 80000-4:2006, *Quantities and units — Part 4: Mechanics*

ISO 80000-5:2007, *Quantities and units — Part 5: Thermodynamics*

IEC 80000-6:2008, *Quantities and units — Part 6: Electromagnetism*

JCGM 100:2008, *Evaluation of measurement data – Guide to the expression of uncertainty in measurement*

3 Names, symbols, and definitions

The names, symbols, and definitions for quantities and units of physical chemistry and molecular physics are given on the following pages.