EESTI STANDARD EVS-EN ISO 80000-9:2013

Quantities and units - Part 9: Physical chemistry and molecular physics (ISO 80000-9:2009 + Amd 1:2011)

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Quantities and units - Part 9: Physical chemistry and molecular physics (ISO 80000-9:2009 + Amd 1:2011)

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Größen und Einheiten - Teil 9: Physikalische Chemie und Molekularphysik (ISO 80000-9:2009 + Amd 1:2011)

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

The text of ISO 80000-9:2009 + Amd 1:2011 has been prepared by Technical Committee ISO/TC 12 “Quantities and units” of the International Organization for Standardization (ISO) and has been taken over as EN ISO 80000-9:2013.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2013, and conflicting national standards shall be withdrawn at the latest by October 2013.

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Endorsement notice

The text of ISO 80000-9:2009 + Amd 1:2011 has been approved by CEN as EN ISO 80000-9:2013 without any modification.

Contents

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Introduction

0.1 Arrangements of the tables

The tables of quantities and units in this International Standard are arranged so that the quantities are presented on the left-hand pages and the units on the corresponding right-hand pages.

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 ISO 31, 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 Tables of 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, 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) 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 Tables of units

0.3.1 General

The names of units for the corresponding quantities are given together with the international symbols and the definitions. These 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[1)].

The units are arranged in the following way:

a) The coherent SI units are given first. The SI units have been adopted by the General Conference on Weights and Measures (Conférence Générale des Poids et Mesures, CGPM). The use of coherent SI units

1) To be published.

is recommended; decimal multiples and submultiples formed with the SI prefixes are recommended, even though not explicitly mentioned.

b) Some non-SI units are then given, being those accepted by the International Committee for Weights and Measures (Comité International des Poids et Mesures, CIPM), or by the International Organization of Legal Metrology (Organisation Internationale de Métrologie Légale, OIML), or by ISO and IEC, for use with the SI.

   Such units are separated from the SI units in the item by use of a broken line between the SI units and the other units.

c) Non-SI units currently accepted by the CIPM for use with the SI are given in small print (smaller than the text size) in the “Conversion factors and remarks” column.

d) Non-SI units that are not recommended are given only in annexes in some parts of this International Standard. These annexes are informative, in the first place for the conversion factors, and are not integral parts of the standard. These deprecated units are arranged in two groups:

   1) units in the CGS system with special names;

   2) units based on the foot, pound, second, and some other related units.

e) Other non-SI units are given for information, especially regarding the conversion factors, in informative annexes in some parts of this International Standard.

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, and that the unknown value of l is believed to lie 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.

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.

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

The superscript * is used to mean “pure”. The superscript $^\ominus$ is used to mean “standard”.

EXAMPLE 1 V_m ($\mathrm{K_2SO_4}$, 0,1 mol · dm^{-3} in $\mathrm{H_2O}$, 25 °C) for molar volume.

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

In an expression such as $\varphi_\mathrm{B} = x_\mathrm{B} V^*_{\mathrm{m,B}} / \sum x_i V^*_{\mathrm{m},i}$, 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 $\sum x_i = 1$.

The names and symbols of the chemical elements are given in Annex A.

Additional qualifying information on a quantity symbol may be added as a subscript or superscript 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*

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.

