SLOVENSKI STANDARD
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Veličine in enote - 12. del: Fizika kondenzirane snovi (ISO/DIS 80000-12:2015)

Quantities and units - Part 12: Condensed matter physics (ISO/DIS 80000-12:2015)

Größen und Einheiten - Teil 12: Physik der kondensierten Materie (ISO/DIS 80000-12:2015)

Grandeurs et unités - Partie 12: Physique de la matière condensée (ISO/DIS 80000-12:2015)

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01.060	Veličine in enote	Quantities and units
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INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION
INTERNATIONAL ELECTROTECHNICAL COMMISSION • МЕЖДУНАРОДНАЯ ЭЛЕКТРОТЕХНИЧЕСКАЯ КОММИСИЯ • COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

Quantities and units —

Part 12:
Condensed matter physics

Grandeurs et unités —

Partie 12: Physique de la matière condensée

ICS 01.060

ISO/CEN PARALLEL PROCESSING

This final draft has been developed within the International Organization for Standardization (ISO), and processed under the **ISO-lead** mode of collaboration as defined in the Vienna Agreement. The final draft was established on the basis of comments received during a parallel enquiry on the draft.

This final draft is hereby submitted to the ISO member bodies and to the CEN member bodies for a parallel two-month approval vote in ISO and formal vote in CEN.

Positive votes shall not be accompanied by comments.

Negative votes shall be accompanied by the relevant technical reasons.

This draft is submitted to a parallel enquiry in ISO and a CDV vote in the IEC.

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 80000-12 was prepared by Technical Committee ISO/TC 12, *Quantities and units*, Subcommittee SC , .

This second/third/... edition cancels and replaces the first/second/... edition (ISO 80000-12:2009), [clause(s) / subclause(s) / table(s) / figure(s) / annex(es)] of which [has / have] been technically revised.

ISO 80000 consists of the following parts, under the general title *Quantities and units — Condensed matter physics*:

— *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*

Quantities and units — Condensed matter physics

1 Scope

This part of ISO 80000 gives names, symbols and definitions for quantities and units of condensed matter physics. Wh
given.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, o
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*
- *ISO 80000-8:2007, Quantities and units — Part 8: Acoustics*
- *ISO 80000-9:2009, Quantities and units — Part 9: Physical chemistry and molecular physics*
- *ISO 80000-10:2009, Quantities and units — Part 10: Atomic and nuclear physics*

CODATA values: The indicated values are the last known before publication. The user is advised to refer to th
http://physics.nist.gov/cuu/Constants/index.html

3 Quantities, units and definitions

Item No.	Quantity			Unit	
	Name	**Symbol**	**Definition**	**Symbol**	**Remarks**
12-1.1	lattice vector	$\boldsymbol{R}$	translation vector that maps the crystal lattice on itself	m Å	For ångström (Å), see ISO 80000-3:2006, item 3-1.a.
12-1.2	fundamental lattice vectors	$\boldsymbol{a}_1, \boldsymbol{a}_2, \boldsymbol{a}_3$, $\boldsymbol{a}, \boldsymbol{b}, \boldsymbol{c}$	fundamental translation vectors for the crystal lattice	m^{-1}	$\boldsymbol{R} = n_1\boldsymbol{a}_1 + n_1\boldsymbol{a}_1 + n_2\boldsymbol{a}_2 + n_3\boldsymbol{a}_3$ where n_1, n_2 and n_3 are integers.
12-2.1	angular reciprocal lattice vector	$\boldsymbol{G}$	vector whose scalar products with all fundamental lattice vectors are integral multiples of 2π	m	In crystallography, however, the quantity $\frac{\boldsymbol{G}}{2\pi}$ is sometimes used.
12-2.2	fundamental reciprocal lattice vectors	$\boldsymbol{b}_1, \boldsymbol{b}_2, \boldsymbol{b}_3$	fundamental translation vectors for the reciprocal lattice		$\boldsymbol{a}_i \cdot \boldsymbol{b}_i = 2\pi\delta_{ij}$ In crystallography, however, the quantities $\frac{\boldsymbol{b}_j}{2\pi}$ are also often used.
12-3	lattice plane spacing	d	distance between successive lattice planes	m Å	For ångström (Å), see ISO 80000-3:2006, item 3-1.a.
12-4	Bragg angle	ϑ	angle defined by the equation $2d \sin \vartheta = n\lambda$ where d is the lattice plane spacing (item 12-3), λ is the wavelength (ISO 80000-7:2008, item 7-3) of the radiation, and n is an integer OR angle between the scattered ray and the lattice plane	rad °	For degree (°), see ISO 80000-3:2006, item 3-5.b.
12-5	order of reflexion	n		1	

Item No.	Quantity			Unit	
	Name	**Symbol**	**Definition**	**Symbol**	**Remarks**
12-6.1	short-range order parameter	*r*, *σ*	fraction of nearest-neighbour atom pairs in an Ising ferromagnet having magnetic moments in one direction, minus the fraction having magnetic moments in the opposite direction	1	Similar definitions apply to other order-disorder phenomena. Other symbols are frequently used.
12-6.2	long-range order parameter	*R*, *s*	fraction of atoms in an Ising ferromagnet having magnetic moments in one direction, minus the fraction having magnetic moments in the opposite direction		Similar definitions apply to other order-disorder phenomena. Other symbols are frequently used.
12-6.3	atomic scattering factor	*f*	quotient of radiation amplitude scattered by the atom and radiation amplitude scattered by a single electron		This can be expressed by: $f = \frac{E_a}{E_e}$ where E_a is the radiation amplitude scattered by the atom and E_e is the radiation amplitude scattered by a single electron.
12-6.4	structure factor	*F(h, k, l)*	$F(h,k,l) = \sum_{n=1}^{N} f_n \exp[2\pi i(hx_n + ky_n + lz_n)]$ where f_n is the atomic scattering factor (item 12.6.3) for atom n, and x_n, y_n, z_n are fractional coordinates in the unit cell; for h, k, l, see Annex A		
12-7	Burgers vector	***b***	vector characterizing a dislocation	m	The closing vector in a Burgers circuit encircling a dislocation line.

Item No.	Quantity			Unit	
	Name	Symbol	Definition	Symbol	Remarks
12-8.1	particle position vector	***r***, ***R***	position vector (ISO 80000-3:2006, item 3-1.11) of a particle	m	Often, ***r*** is used for electrons and ***R*** is used for atoms and other heavier particles.
12-8.2	equilibrium position vector (of an ion or an atom)	$\boldsymbol{R}_0$	position vector (ISO 80000-3:2006, item 3-1.11) of an ion or atom in equilibrium		
12-8.3	displacement vector (of an ion or atom)	***u***	the difference between the position vector of an ion or atom and its position vector in equilibrium		This can be expressed by: $\boldsymbol{u} = \boldsymbol{R} - \boldsymbol{R}_0$ where ***R*** is particle position vector (item 12-8.1) and $\boldsymbol{R}_0$ is position vector of an ion or atom in equilibrium (item 12-8.2).
12-9	Debye-Waller factor	*D*, *B*	factor by which the intensity of a diffraction line is reduced because of the lattice vibrations	1	*D* is sometimes expressed as $D = \exp(-2W)$; in Mössbauer spectroscopy, it is also called the *f* factor and denoted by *f*.
12-10.1	angular wavenumber, angular repetency	*k*, (*q*)	linear momentum divided by the reduced Planck constant	rad m^{-1} m^{-1}	The corresponding vector quantity ***k*** or ***q*** is called the wave vector. This can be expressed by: $k = \frac{p}{\hbar}$ where *p* is the linear momentum (ISO 80000-
12-10.2	Fermi angular wavenumber, Fermi angular repetency	k_F	angular wavenumber (item 12-10.1) of electrons in states on the Fermi sphere		

Item No.	Quantity			Unit	
	Name	**Symbol**	**Definition**	**Symbol**	**Remarks**
12-10.3	Debye angular wavenumber, Debye angular repetency	q_D	cut-off angular wavenumber (item 12-10.1) in the Debye model of the vibrational spectrum of a solid	rad m^{-1} m^{-1}	4:2006, item 4-8) of quasi free electrons in an electron gas and $\hbar$ is the Planck constant h (ISO 80000-10:2009, item 10-6.1), divided by 2π; for phonons, its magnitude is $k = \frac{2\pi}{\lambda}$ where λ is the wavelength (ISO 80000-3:2006, item 3-17) of the lattice vibrations. When a distinction is needed between and the symbol for the Boltzmann constant, k_B can be used for the latter. When a distinction is needed, q should be used for phonons, and k for particles such as electrons and neutrons. The method of cut-off shall be specified. In condensed matter physics, angular wavenumber is often called wavenumber.
12-11	Debye angular frequency	ω_D	cut-off angular wavenumber (item 12-10.1) in the Debye model of the vibrational spectrum of a solid	rad s^{-1} s^{-1}	The method of cut-off shall be specified.
12-12	Debye temperature	Θ_D	in the Debye model $\Theta_D = \hbar\frac{\omega_D}{k}$ where k is the Boltzmann constant, (ISO 80000-8:2009, item 8.-37), $\hbar$ is the Planck constant (ISO 80000-10:2009, item 9-7), divided by 2π, and ω_D is Debye angular frequency (item 12-11)	K	A Debye temperature may also be defined by fitting a Debye model result to a certain quantity, for instance, the heat capacity at a certain temperature.