International Atomic Energy Agency

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INDC INTERNATIONAL NUCLEAR DATA COMMITTEE

USSR State Committee on the Utilization of Atomic Energy
Nuclear Data Centre

NUCLEAR CONSTANTS
No. 8

PROVIDING NUCLEAR DATA FOR FAST REACTOR CALCULATIONS

Part 2

Translated by
the International Atomic Energy Agency

Vienna, July 1974

IAEA NUCLEAR DATA SECTION, KÄRNTNER RING 11, A-1010 VIENNA

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Central Scientific Research Institute
for Atomic Information
Moscow 1972

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NUCLEAR CONSTANTS

Editor: L.I. Malkova Proof reader: N.P. Gerasimova

Authorized for printing 21.9.1972 Number printed: 350 copies

Rotaprinted by TsNIIatominform, Moscow, G-146, P.O. Box 584

Issue No. 8 of "Nuclear Constants" consists of four volumes containing reports on work performed at the Institute of Physics and Power Engineering of the USSR State Committee on the Utilization of Atomic Energy in 1969 and 1970. The purpose of this work was to provide constants for neutron calculations relating to fast reactors and radiation shielding.

The second volume (part) deals with the determination of group constants for individual elements and isotopes. A method is described by which it is possible to calculate the angular momenta of the matrices of intergroup transitions in the case of elastic scattering, taking into account the correlation between neutron energies and the angle of emission. Multigroup matrices are provided for the first six angular momenta of elastic slowing down for a large number of nuclei. Tables show multigroup cross-sections for the capture of stable fission fragments. The volume also contains an algorithm and a programme for the calculation of sub-group parameters by simultaneous analysis of several transmission functions using the method of least squares.

GROUP PARAMETERS FOR THE ANISOTROPY OF NEUTRON SCATTERING

N.O. Bazazyants, A.S. Zabrodskaya and
M.N. Nikolaev

Introduction

The 26-group system of constants [1] is designed to provide nuclear data only for those neutron calculations in which the anisotropy of scattering is taken into account either in the P_1 or in the transport approximation. In some cases these approximations are inadequate, for example in many neutron shielding calculations [2]. Hence, in calculating the passage of neutrons through large thicknesses of material (where there is a flux attenuation of up to ten orders of magnitude) it is necessary to take into account three or four terms for the expansion of the scattering indicatrix [3]. A still more precise calculation of scattering anisotropy is necessary when calculating the passage of neutrons through non-uniformities in shielding.

To obtain a correct description of fast neutron fluxes in small reactors we also need more accurate allowance for scattering anisotropy than can be provided by the transport approximation.

Moreover, the fact that we do not have systems of multigroup scattering anisotropy parameters compiled with sufficient accuracy seriously limits the practical application of programmes for the precise calculation of radiation shielding (for example programmes of the ROZ type [4]).

Thus the need for group constants that would allow scattering anisotropy to be taken into account became extremely urgent and the aim of the present work is to satisfy that need.

Our paper is devoted to the establishment of a theoretical basis for methods of taking into account elastic and inelastic slowing down of neutrons in multigroup approximations; the development of practical algorithms for calculating group parameters for slowing down anisotropy (i.e. matrices of cross-sections and angular momenta of intergroup transitions during scattering),

taking into account the energy losses due to product nucleus recoil; the compilation, on the basis of these algorithms, of tables listing the parameters of intergroup transitions in elastic scattering for a wide range of elements. Recommended energy dependences of the coefficients for Legendre polynomial expansion of the elastic scattering indicatrices, as evaluated by us [5] and presented in numerical tabular form [6], were used in this work.

The numerical results obtained for the sub-division adopted in the 26-group system of constants [1] are set out in the Annex. The Annex contains tables of group parameters relating to the anisotropy of elastic neutron slowing down for 41 nuclei (from deuterium to plutonium-239) obtained with the help of the $A_{\ell m}$ matrices (see Section 5) set out in Ref. [13]. In view of the large volume of numerical information appropriate programmes were drawn up to print the tables, for which the alphanumeric data printer of the M-220 computer was used.

The programme applying the algorithm developed in the course of the work - for deriving group parameters on the anisotropy of elastic and inelastic neutron scattering - is written in ALGOL-60 and is at present being checked out. It includes in particular the case of inelastic scattering isotropic in the centre-of-inertia system of co-ordinates, programmed earlier by V.V. Vakhromeeva in M-20 computer codes.

A serious difficulty in compiling parameters for inelastic scattering anisotropy is the absence of evaluated data on the anisotropy of inelastically scattered neutrons.

1. Kinetic equation for a neutron flux averaged over the resonance structure

In neutron calculations for reactors and radiation shielding one never has to determine all details of the flux due to the resonance structure of the cross-sections of the medium; it is quite sufficient to know the "structure-averaged" neutron flux. It is tempting to write a kinetic equation for the smoothed neutron flux such that the equation contains smoothed neutron cross-sections effectively averaged over the resonances in such a way as to allow a direct calculation of the smoothed flux. This approach would have an additional advantage as the precise cross-sectional energy dependence, which takes the resonance structure into account and appears in the precise kinetic equation, is unknown to us throughout the energy region, whereas the averaged cross-sections in the equation for the smoothed flux could perhaps be measured directly or evaluated on the basis of a statistical analysis of the resonance structure of the cross-sections.

The kinetic equation for the smoothed neutron flux, the formulae giving the constants used in the equation and the limits of applicability of the approach were determined in Refs [7, 8]. In the spherical harmonics representation the equation has the following form (we adopt for the sake of simplicity the case of unidimensional plane-parallel geometry):

$$\bar{\Sigma}_0(E)\cdot\bar{F}_0(x,E)+\frac{\partial\bar{F}_1(x,E)}{\partial x}=Q_0(x,E)+$$
$$+\sum_m \rho_m\int_E^{E/(1-\Delta_m)}\bar{F}_0(x,E')\cdot\bar{G}^m_{e,0}(E'\to E)\,dE'+\sum_m\rho_m\int_{\Delta E_m}\bar{F}_0(x,E')\cdot\bar{G}^m_{in,0}(E'\to E)\,dE'; \tag{1a}$$

$$\bar{\Sigma}_\ell(E)\cdot\bar{F}_\ell(x,E)+\frac{1}{2\ell+1}\left[(\ell+1)\frac{\partial\bar{F}_{\ell+1}(x,E)}{\partial x}+\ell\frac{\partial\bar{F}_{\ell-1}(x,E)}{\partial x}\right]=$$
$$\sum_m\rho_m\int_E^{E/(1-\Delta_m)}\bar{F}_\ell(x,E')\cdot\bar{G}^m_{e,\ell}(E'\to E)\,dE'+\sum_m\rho_m\int_{\Delta E_m}^{E+\Delta E/2}\bar{F}_\ell(x,E')\cdot\bar{G}^m_{in,\ell}(E'\to E)\,dE'; \quad (\ell\geq 1) \tag{1b}$$

where
$$\bar{F}_\ell(x,E)=\frac{1}{\Delta E}\int_{E-\Delta E/2}^{E+\Delta E/2}F_\ell(x,E')\,dE'=\langle F_\ell\rangle \tag{2}$$

is the ℓth neutron flux harmonic averaged over the interval ΔE around energy E, i.e. the coefficient before the ℓth polynomial in the expansion of the neutron flux in Legendre polynomials:

$$F(x,E,\mu)=\frac{1}{4\pi}\sum_{\ell=0}^{\infty}F_\ell(x,E)\cdot P_\ell(\mu),$$
$$F_\ell(x,E)=2\pi(2\ell+1)\int_{-1}^{+1}F(x,E,\mu)\cdot P_\ell(\mu)\,d\mu, \tag{3}$$

$Q_0(x,E)$ is the density of neutron sources with energy E at point x (the sources are considered to be isotropic);

μ is the cosine of the angle determining the direction of neutron movement;

$\bar{\Sigma}_\ell(E)$ is the total cross-section of the medium averaged over the spectrum of the ℓth harmonic of the flux in the interval ΔE:

$$\bar{\Sigma}_\ell(E)=\frac{\int_{\Delta E}\Sigma(E')\cdot F_\ell(x,E')\,dE'}{\int_{\Delta E}F_\ell(x,E')\,dE'}=\frac{\langle\Sigma\cdot F_\ell\rangle}{\langle F_\ell\rangle}, \tag{4}$$

α_m is the maximum relative energy loss resulting from elastic scattering on m-type nuclei: $\alpha_m = \frac{4A_m}{(A_m+1)^2}$ (A_m = the atomic weight of the nucleus);

Q_m is the density of nuclei of the m type;

$\bar{\sigma}^m_{e,\ell}(E' \to E)$ and $\bar{\sigma}^m_{in,\ell}(E' \to E)$ are the cross-sections for elastic and inelastic scattering leading to the indicated change in energy:

$$\bar{\sigma}^m_{s,\ell}(E' \to E) = \frac{\int_{\Delta E'} \sigma^m_s(E'') \cdot S'^m_{s,\ell}(E'' \to E) \cdot F_\ell(x, E'') \cdot dE''}{\int_{\Delta E'} F_\ell(x, E'') \cdot dE''} = \frac{\langle F_\ell \cdot \sigma^m_s \cdot S'^m_{s,\ell} \rangle}{\langle F_\ell \rangle}, \tag{5}$$

where $S'^m_{s,\ell}(E' \to E)$ is the coefficient before the ℓth polynomial in the expansion of the scattering angular distribution in Legendre polynomials:

$$S'^m_s(E' \to E, \mu_0) = \frac{1}{4\pi} \sum_{\ell=0}^{\infty} S'^m_{s,\ell}(E' \to E) \cdot P_\ell(\mu_0), \tag{6}$$

i.e.

$$S'^m_{s,\ell}(E' \to E) = 2\pi(2\ell+1) \int_{-1}^{+1} S'^m_s(E' \to E, \mu_0) \cdot P_\ell(\mu_0) \cdot d\mu_0 \tag{7}$$

and $S'^m_s(E' \to E, \mu_0)$ is the ratio of the differential cross-section for scattering on the mth isotope at an angle arc Cos μ_0 resulting in the indicated energy change to the total scattering cross-section at energy E' (the subscript s = e relates to elastic scattering, s = in to inelastic scattering).

(n,2n) and (n,3n) reactions are regarded as inelastic scattering, but with doubled (or tripled) cross-sections; fission neutrons are counted as a source term.

Finally, ΔE_m are the intervals of energy E from which inelastic slowing down to E is possible.

As can be seen from formulae (4) and (5), the averaged cross-sections generally depend on the co-ordinates, even in a homogeneous medium. However, as has been shown in the references quoted above, this dependence ceases if the following conditions are met:

1. A region of the medium is considered in which all points are separated from the boundaries and concentrated neutron sources by a distance of several (2-3) maximum neutron free path lengths.

2. The widths of the resonance characteristics are small compared with the energy losses during scattering (narrow resonance approximation).

3. There is no anisotropic scattering with a large energy change (scattering on hydrogen and other light nuclei, anisotropic inelastic scattering).

When all the conditions listed above are met, the averaged cross-sections are indeed independent of the co-ordinates, as within the averaging interval ΔE the space and energy variables in the flux harmonics will be split:

$$F_\ell(x,E) = W_\ell(x,E) \cdot \varphi_\ell(E), \tag{8}$$

where $w_\ell(x,E)$ is a smooth function of energy containing a dependence on the co-ordinates, and

$$\varphi_\ell(E) = \sum_{n=0}^{\ell} a_{\ell-n} \frac{1}{\Sigma(E)^{n+1}} \cdot \tag{9}$$

Here the a_ℓ values are calculated by the recurrence formula

$$a_0 = 1 \tag{10}$$

$$a_\ell = \left(\sum_{n=0}^{\ell-1} a_{\ell-n-1} \left\langle \frac{\Sigma_{e,\ell}(E')}{\Sigma^{n+2}(E')} \right\rangle \right) \Big/ \left(1 - \left\langle \frac{\Sigma_{e,\ell}(E')}{\Sigma(E')} \right\rangle \right), \tag{11}$$ */

*/ Here, as above, the angular brackets denote simple averaging over energy within the small interval ΔE.

$$\Sigma_{e,\ell}(E') = \sum_m \rho_m \int_{E'/(1-\alpha_m)}^{E'} \sigma_{e,\ell}^m(E' \to E)\, dE , \qquad (12)$$

where

$$\left\langle \frac{\Sigma_{e,\ell}(E')}{\Sigma^{n+2}(E')} \right\rangle = \sum_m \frac{\rho_m \cdot \alpha_m}{(1-\alpha_m)E} \int_E^{E/(1-\alpha_m)} \frac{\sigma_{e,\ell}^m(E' \to E)\, dE'}{\Sigma^{n+2}(E')} . \qquad (13)$$

Let us examine the possibility of using our approximation as a means of taking into account the structure of the cross-section.

Violation of condition (3) generally leads to a space dependence of the averaged cross-sections, but this is so slight that in practical calculations it can always be ignored.

Violation of condition (2) is more important, as it leads to irregularity in the energy curve for $\langle \Sigma_{e,\ell} / \Sigma^{n+2} \rangle$, which makes the averaging of the cross-sections difficult. Nevertheless, this difficulty can also be overcome with the help of the so-called "approximation of intermediate resonances" (see for example Section 3 of Ref. [8]).

Most essential for the applicability of our approach is the fulfilment of condition (1), assuming a small flux change at the maximum neutron free path length (i.e. in the region of the lowest minimum in the total cross-section).

This condition is clearly violated near the interfaces between media of different composition (at a distance of 1-3 neutron free path lengths). If (as occurs, for example, in fast power reactors) the dimensions of the homogeneous zones of the reactor system exceed the free path length by a large amount, the boundary regions where space-independent averaged cross-sections cannot be determined, and where consequently a calculation based on averaged cross-sections is inaccurate, occupy only a small part of the total volume of the reactor. In view of this, inaccuracies in the calculation of the flux near the boundaries have little effect on the integral physical characteristics of the system.

The approach we have been considering is that normally used - for the vast majority of existing calculation programmes - when we must allow for the energy dependence of cross-sections and fluxes.

In the present work we aim at deriving constants for programmes of this category; hence we also proceed on the assumption that it is admissible to take account of the resonance structure of the cross-sections by means of the rational averaging referred to above.

2. Multigroup kinetic equations

It has been shown above that in the most general case the neutron flux and cross-sections can be effectively averaged over the resonance structure. After an averaging operation of this kind, solution of the system of equations in expression (1) consists in solving this system, but with cross-sections which are smooth functions of energy.

At the present time very extensive use is being made of the multigroup method for describing the energy dependences of cross-sections and fluxes when solving the kinetic equation. Practically all the neutron calculation programmes for fast reactors and for shielding applied at the present time are based on this method. Let us examine the requirements that must be met by the multigroup constants used in current programmes.

We select, on the energy axis, N discrete values of E_j numbered inversely to the increase in energy:

$$E_{j-1} > E_j \quad , \quad j = 1, 2, 3, \ldots, N.$$

We then combine in the jth group all neutrons having energies within the range E_j, E_{j-1}, so that the neutron flux of the jth group is written as

$$F_j(x, \mu) = \int_{E_j}^{E_{j-1}} F(x, E, \mu)\, dE. \qquad (14)$$

The equations for determining the group fluxes can be obtained by integrating the system of equations in expression (1) over the energy intervals of the groups:

$$\Sigma_o^j \cdot F_{oj}(x) + \frac{\partial F_{1j}(x)}{\partial x} = S'_{oj}(x) + \sum_{i=1}^{k} F_{oi}(x) \cdot \sum_m \rho_m \cdot G^m_{e,o}(i \to j) +$$
$$+ \sum_{i=1}^{k} F_{oi}(x) \cdot \sum_m \rho_m \cdot G^m_{in,o}(i \to j);$$

$$\Sigma_\ell^j \cdot F_{\ell j}(x) + \frac{1}{2\ell+1}\left[(\ell+1) \cdot \frac{\partial F_{\ell+1,j}(x)}{\partial x} + \ell \cdot \frac{\partial F_{\ell-1,j}(x)}{\partial x}\right] =$$
$$= \sum_{i=1}^{j} F_{\ell i}(x) \cdot \sum_m \rho_m \cdot G^m_{e,\ell}(i \to j) + \sum_{i=1}^{k} F_{\ell i}(x) \cdot \sum_m \rho_m \cdot G^m_{in,\ell}(i \to j).$$

where

$$\Sigma_\ell^j = \frac{1}{F_{\ell j}(x)} \int_{E_j}^{E_{j-1}} \bar{\Sigma}_\ell(E) \cdot \bar{F}_\ell(x,E) \cdot dE \qquad (16)$$

$$\bar{\sigma}_{s,\ell}^m (i \to j) = \frac{1}{F_{\ell i}(x)} \int_{E_i}^{E_{i-1}} dE' \int_{E_j}^{E_{j-1}} \bar{\sigma}_{s,\ell}^m (E' \to E) \cdot \bar{F}_\ell(x,E') \cdot dE, \quad s = e, in; \qquad (17)$$

and

$$F_{\ell j}(x) = \int_{E_j}^{E_{j-1}} \bar{F}_\ell(x,E) dE, \qquad (18)$$

$$S_{oj}(x) = \int_{E_j}^{E_{j-1}} S_o(x,E) dE. \qquad (19)$$

The ultimate aim of the neutron calculation is usually to calculate the neutron fluxes $F_{\ell j}(x)$ or the reaction rates. In a group approximation the number of type r^j reactions occurring at point x of the system under consideration should be calculated as

$$R_m(x) = \rho_m \sum_{j=1}^{N} F_{oj}(x) \cdot \bar{\sigma}_{rj}^m, \qquad (20)$$

where σ_{rj}^m is the cross-section of the type-r reaction of the mth element of the medium in group j:

$$\bar{\sigma}_{rj}^m = \frac{1}{F_{oj}(x)} \int_{E_j}^{E_{j-1}} \bar{\sigma}_r^m(E) \cdot \bar{F}_o(x,E) \cdot dE, \qquad (21)$$

where it is assumed that $\bar{\sigma}_r^m(E)$ is the cross-section averaged over the resonances.

For example, to calculate the source term $S_{oj}(x)$ it is necessary to know the group fission cross-sections σ_{fi}^m, the number of secondary neutrons per fission ν_i^m, and the group shares of the fission spectrum χ_j:

$$S_{oj}(x) = S_{o\,внешн}(x) + \chi_j \cdot \sum_{i=1}^{N} F_i \cdot \sum_m \rho_m \cdot \bar{\sigma}_{fi}^m \cdot \nu_i^m, \qquad (22)$$

where

$$\chi_j = \int_{E_j}^{E_{j-1}} \chi(E) \cdot dE; \qquad (23)$$

and

$$\nu_i^m = \frac{\int_{E_j}^{E_{j-1}} \nu(E)\cdot\bar{\sigma}_f^m(E)\cdot\bar{F}_{oi}(E)\cdot dE}{\int_{E_j}^{E_{j-1}} \bar{\sigma}_f^m(E)\cdot\bar{F}_{oi}(E)\cdot dE} \qquad (24)$$

As can be seen from expressions (16), (17) and (21), the group cross-sections Σ_ℓ^j , σ_{rj}^m and $\sigma_{s\ell}^m(i\to j)$ are generally functions of the co-ordinates. As the calculation with space-dependent cross-sections is extremely complex - and in order to calculate them we need to know the functions $\bar{F}_\ell(x,E)$ which are initially unknown - these cross-sections have been replaced by constants in the multigroup approximation.

There are two approaches to the optimum selection of constants. In the first the selection is made in such a way that replacement of the space-dependent cross-sections by constants preserves the exact value of one or other of the quantities, e.g. K_{eff}. It can be shown [9] that in this case the space-dependent cross-sections in expressions (16) and (17) should be averaged over the uniform regions of the reactor with the weighting function determined by the quantity whose value is to be preserved. This method of averaging the cross-sections can usefully be applied when the number of groups is small and the groups themselves correspondingly wide, so that owing to the space dependence of the ageraging spectra, $\bar{F}_\ell(x,E)$, the group constants in expressions (16), (17) and (21) are strongly dependent on the co-ordinates. It is natural to describe this procedure as a method of averaging cross-sections in a few-group approximation.

In the multigroup approximation, where the groups are rather narrow, the group constants in expressions (16) and (17) are very weak functions of the co-ordinates since $\bar{\Sigma}(E)$, $\bar{\sigma}_r^m(E)$ and $\bar{\sigma}_{s\ell}^m(E)$ are slowly varying functions of energy (averaging over the resonance characteristics has already been carried out). In this case the problem of averaging the group constants over the space co-ordinates ceases to exist. There remains only the problem of averaging over energy, for which the unknown $\bar{F}_\ell(x,E)$ spectra must be replaced by some average spectrum $\varphi(E)$. If we wish to use in our calculations the previously compiled microscopic group constants for individual elements, such as

$\sigma^m_{s\ell}(i\to j)$, σ^m_{rj} and $\sigma^m_{\ell j}$ (so that $\Sigma^m_\ell = \sum_m \rho_m \cdot \sigma^m_{\ell j}$), it is necessary to select some universal "standard" spectrum $\varphi(E)$. The use of a standard spectrum instead of the $\bar{F}_\ell(x,E)$ spectra undoubtedly leads to certain inaccuracies in the calculation of group constants. However, if the groups are narrow enough these inaccuracies will be smaller than the uncertainties associated with inadequate knowledge of the energy dependence of the cross-sections, and in this case they can be ignored. Analysis shows ([3]) that, given the current accuracy with which we know the cross-sections, this is true with regard to the total cross-sections $\sigma^m_{\ell j}$ and the reaction cross-sections σ^m_{rj} when the width of the group in lethargy units is less than 0.5 to 1.0. This condition is fulfilled in the 26-group system of constants [1], where the group width does not exceed 0.77. In groups with widths of this order or smaller the choice of a form for the standard spectrum $\varphi(E)$ is not very important for the determination of the group constants. For example, one can use the standard spectrum adopted in Ref. [1]: a Fermi spectrum for energies of less than 2.5 MeV and a fission spectrum for higher energies.

It is a different matter with slowing down cross-sections, particularly the elastic slowing down cross-section $\sigma^m_{e\ell}(i\to j)$. If the width of the group is larger than the maximum energy loss in scattering, the group parameters are strongly dependent on the form of standard spectrum adopted, even when the scattering cross-section is strictly constant. We shall derive the elastic slowing down cross-section for this case from expression (17), taking into account the fact that $\sigma^m_{e\ell}(E'\to E) \equiv 0$ for $E'(1-\alpha_m) < E < E'$ when $E'\cdot\alpha_m < (E_{j-2} - E_{j-1})$:

$$\sigma^m_{e\ell}(i\to j) = \frac{1}{F_{\ell j-1}} \int_{E_{j-1}}^{E_{j-1}/(1-\alpha_m)} dE' \cdot \bar{\varphi}_\ell(x,E') \int_{E'(1-\alpha_m)}^{E_{j-1}} \sigma^m_{s\ell}(E'\to E)\,dE =$$

$$= \sigma^m_{e,\ell,i} \frac{\int_{E_{j-1}}^{E_{j-1}/(1-\alpha_m)} \bar{\varphi}_\ell(x,E')\,dE'}{\int_{E_{j-1}}^{E_{j-2}} \bar{\varphi}_\ell(x,E)\,dE}, \qquad (25)$$

where i = j-1. For $i < j-1$ $\sigma^m_{e\ell}(i\to j) = 0$.

From expression (25) it will be seen that the elastic slowing down cross-section depends to a large extent on the form of the intragroup spectrum, even if the space dependence of $\overline{F}_\ell(x,E)$ is weak. It is therefore natural in the multigroup approximation to determine the slowing down cross-section in the following way. First $\sigma^m_{e,\ell,i}$ is calculated by averaging $\sigma^m_{e,\ell}(E)$ in group i over the standard spectrum $\varphi(E)$. Then the integral spectrum within group i is determined on the assumption that all the cross-sections within the given group are constant. For this calculation we can use easily calculated spectra for an infinite medium or a fundamental harmonic (if there is a fissionable nucleus in the medium). Finally, using formula (25) we calculate the elastic slowing down cross-section on the assumption that the spectra of all the harmonics of the neutron flux coincide (i.e. that the anisotropy of the smoothed flux within the group remains essentially unchanged). In the M-26 programme complex [10] now in use at the Institute of Physics and Power Engineering the very simple algorithm described in Ref. [14] is used to correct the slowing down cross-section for the shape of the intragroup spectrum. In the recently developed programme of macroconstants ARAMAKO [11] the intragroup spectrum is calculated more correctly by subdividing each individual group into a large number of narrower groups.

The uncertainty in the elastic slowing down cross-sections is a disadvantage inherent in the multigroup method, and within the limits of the method it cannot be completely eliminated. Specifically, the algorithm proposed for obtaining the elastic slowing down cross-sections already represents a departure from consistent application of the multigroup method, since the intragroup spectra in the infinite medium must be determined either analytically or by sub-dividing each group into a large number of much narrower groups for which the uncertainties in the choice of slowing down cross-sections would be small.

If the energy loss in inelastic scattering is less than the width of the group, the inelastic slowing down cross-sections can be calculated in precisely the same way as the elastic (see formula 25). If, as is usually the case, the energy loss in inelastic scattering is large, the uncertainty in the choice of the intragroup spectrum is negligible.

Let us now turn to the calculation of multigroup parameters of scattering anisotropy, i.e. the values of $\sigma^m_{s\ell}(i\to j)$, which are given in Ref. [1] only for $\ell = 0$ and (in the case of light nuclei) $\ell = 1$.

3. The kinematics of scattering and the derivation of a formula for the angular momenta of the scattering indicatrix

In determining the group parameters for scattering anisotropy we shall consider elastic scattering to be a particular case of inelastic scattering, i.e. scattering as a result of which the nucleus assumes the ground state (scattering at a level of $E_o^k = 0$). Hence we shall first examine inelastic scattering, calculating the angular distribution $S_\ell^{in}(E' \to E)$ for it, after which we shall proceed to elastic scattering.

Calculation of the function $S_\ell^{in}(E' \to E)$ requires the use of certain relationships which can be derived from the laws of conservation of momentum and energy applied to the case of inelastic scattering with excitation of the level E_o^k.

We shall introduce the following symbols:

The laboratory system of co-ordinates (the L system)

V' = neutron velocity before collision

V = neutron velocity after collision

V_o' = velocity of the nucleus before collision

V_o = velocity of the nucleus after collision

$V_c' = V_c$ = velocity of the centre of inertia before and after collision

Centre-of-mass system of co-ordinates (the C system)

W' = neutron velcity before collision

W = neutron velocity after collision

W_o' = velocity of the nucleus before collision

W_o = velocity of the nucleus after collision

$W_c' = W_c = 0$ = velocity of the centre of mass

As usual, in the laboratory system of co-ordinates the target nucleus is considered to be stationary before collision, while in the centre-of-mass system the centre of mass of the system (neutron plus nucleus) is considered to be stationary both before and after collision.

As is usually done in the case of neutron elastic scattering, we shall examine inelastic scattering by the methods of classical mechanics, assuming that the neutron and the scattering nucleus behave in inelastic collision as

ideally elastic spheres, and allowing for the fact that excitation of the nucleus in scattering reduces the kinetic energy of the whole system by E_o^k.

Since theoretical analysis takes a simpler form in the case of the C system, it is practical to write the laws of conservation in this system, to determine the velocity of the neutron and nucleus before and after collision at this stage, and then to proceed to the L system.

The laws of conservation of momentum and energy are

$$\vec{W} + A\vec{W}_o = \vec{W}' + A\vec{W}_o', \tag{26}$$

$$\frac{W^2}{2} + A\frac{W_o^2}{2} = \frac{W'^2}{2} + A\frac{W_o'^2}{2} - E_o^k. \tag{27}$$

Figs 1 and 2 show the senses of the velocities and the relative positions of the neutron and nucleus in the L and C systems before and after collision.

L system

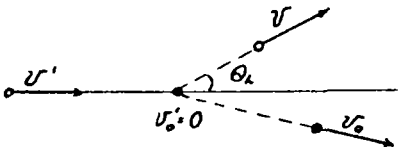


Fig. 1

C system

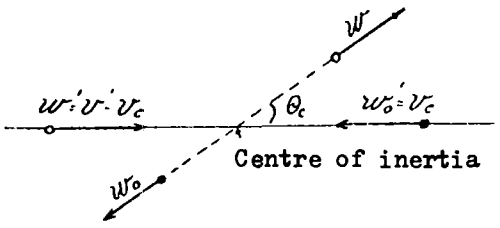


Fig. 2

Here and below, the angle ϑ_L (or ϑ_C), and also $\cos\vartheta_L = \mu_L$ (or $\cos\vartheta_C = \mu_C$) correspond to the angle arc $\cos\mu_o$ (cf section 1) in the L (or C) system.

In view of the fact that before collision the nucleus in the L system is at rest, the momentum of the whole system is equal to the neutron momentum $1 \times V'$. At the same time the total mass of the colliding particles is A + 1, and consequently the velocity of the centre of mass before collision in the L system, i.e. relative to the stationary nucleus, is

$$v_c = \frac{v'}{A+1}. \tag{28}$$

In the C system the centre of mass is at rest. For this condition to be fulfilled the nucleus in this system must move towards the centre of mass at a velocity of $W_o' = V_c$. As the velocity of the neutron relative to the nucleus before collision is V', the neutron must move towards the centre of mass with a velocity $W' = V' - V_c$ or

$$W' = \frac{A \cdot v'}{A+1}. \tag{29}$$

It is now possible to determine the momenta of the neutron and nucleus. Obviously they are respectively equal to

$$1 \cdot W = \frac{A \cdot V'}{A+1} \quad \text{and} \quad A \cdot W_o' = \frac{A V'}{A+1} \tag{30}$$

and are directed towards one another. Consequently, the total momentum of the system before collision is equal to zero, and according to the law of conservation of momentum it should be zero after collision too. As the centre of mass always lies on the straight line connecting the interacting particles, when the neutron moves away from the nucleus after collision the recoil nucleus should move in the opposite direction, and this means, if the total momentum of the system remains the same, that

$$1 \cdot W = A W_o. \tag{31}$$

We shall now establish the velocity of the neutron and nucleus after collision; to do this we substitute the values applicable before collision in equation (27) and make use of relation (31):

$$\frac{A^2 W_o^2}{2} + \frac{A \cdot W_o^2}{2} = \frac{A^2}{(1+A)^2} \cdot \frac{V'^2}{2} + \frac{A}{(1+A)^2} \frac{V'^2}{2} - E_o^k, \tag{32}$$

whence we have

$$W_o^2 = \frac{1}{(1+A)^2} \cdot V'^2 - \frac{2}{A(1+A)} \cdot E_o^k, \tag{33}$$

$$W^2 = \frac{A^2}{(1+A)^2} \cdot V'^2 - \frac{2A}{(1+A)} \cdot E_o^k. \tag{34}$$

As the L and C systems always move relative to one another with the velocity of the centre of mass in the L system, in order to determine the neutron velocity of interest to us in the laboratory system of co-ordinates it is necessary to add vectorially to the neutron velocity in the C system the velocity of the centre of mass in the laboratory system of co-ordinates, i.e.

$$\vec{V} = \vec{W} + \vec{v_c} \quad . \tag{35}$$

From expressions (35), (28) and (29) it follows that

$$\vec{V} = \vec{W} + \frac{1}{A} \vec{W}'. \tag{36}$$

From expressions (35) and (36), solving the velocity triangle (Fig. 3), we have respectively

$$V^2 = W^2 + v_c^2 + 2W \cdot v_c \cdot \cos \theta_c, \tag{37}$$

$$V^2 = W^2 + \frac{1}{A^2} W'^2 + \frac{2}{A} \cdot W \cdot W' \cos \theta_c, \tag{38}$$

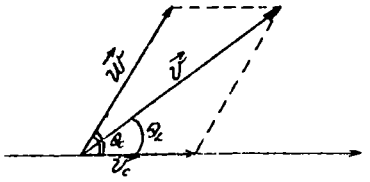


Fig. 3

where ϑ_c is the angle between $\vec{W}$ and $\vec{W}'$ (the scattering angle in the centre-of-mass system) and

$$\cos\theta_c = \frac{(\vec{W}\cdot\vec{W}')}{W\cdot W'}. \tag{39}$$

From expression (38) it follows that

$$\cos\theta_c = \frac{A}{2W\cdot W'}\left[V^2 - W^2 - \frac{1}{A^2}W'^2\right]. \tag{40}$$

Substituting W and W' from expression (34) and (29) in expression (40), we have:

$$\mu_c = \cos\theta_c = \frac{\left\{1 + (A+1)\frac{E_0^k}{V'^2} - \frac{(A+1)^2}{2A}\left[1 - \left(\frac{V}{V'}\right)^2\right]\right\}}{\sqrt{1 - \frac{2(A+1)}{A}\cdot\frac{E_0^k}{V'^2}}}. \tag{41}$$

or

$$\mu_c = \cos\theta_c = \frac{\left\{1 + \frac{A+1}{2}\cdot\frac{E_0^k}{E'} - \frac{(A+1)^2}{2A}\left[1 - \frac{E}{E'}\right]\right\}}{\sqrt{1 - \frac{(A+1)}{A}\frac{E_0^k}{E'}}}. \tag{42}$$

In order to find the scattering angle in the laboratory system of co-ordinates, we use relation (36), projecting $\vec{V}$ in the direction $\vec{W}'$, which coincides with $\vec{V}'$:

$$V\cdot\cos\theta_L = W\cdot\cos\theta_c + \frac{1}{A}\cdot W'. \tag{43}$$

Inserting expressions (34), (41) and (29) here, we get

$$\mu_L = \cos\theta_L = \frac{A+1}{2}\left(\frac{V}{V'}\right) - \frac{A-1}{2}\left(\frac{V'}{V}\right) + A\frac{E_0^k}{V'\cdot V}. \tag{44}$$

or

$$\mu_L = \cos\theta_L = \frac{A+1}{2}\sqrt{\frac{E}{E'}} - \frac{A-1}{2}\sqrt{\frac{E'}{E}} + A\frac{E_0^k}{\sqrt{E\cdot E'}}, \tag{45}$$

where ϑ_L is the scattering angle in the laboratory system of co-ordinates. Solving equation (42) for E, we obtain a relation linking the neutron energies before and after inelastic scattering:

$$E = E'\left[1 - \frac{2A}{(A+1)^2}\left(1 + \frac{A+1}{2}\cdot\frac{E_0^k}{E'} - \mu_c\sqrt{1 - \frac{A+1}{A}\cdot\frac{E_0^k}{E'}}\right)\right]. \tag{46}$$

If $\mu_c = +1$, then as a result of scattering the neutron will have the maximum of all possible energies (cf. expression (47)), and if $\mu_c = -1$, it will have the minimum (cf. expression (48)):

$$E_{max} = E'\left[1 - \frac{2A}{(A+1)^2}\left(1 + \frac{A+1}{2}\cdot\frac{E_0^k}{E'} - \sqrt{1 - \frac{A+1}{A}\cdot\frac{E_0^k}{E'}}\right)\right], \quad (47)$$

$$E_{min} = E'\left[1 - \frac{2A}{(A+1)^2}\left(1 + \frac{A+1}{2}\cdot\frac{E_0^k}{E'} + \sqrt{1 - \frac{A+1}{A}\cdot\frac{E_0^k}{E'}}\right)\right] \quad (48)$$

E_{max} and E_{min} can conveniently be written in the form

$$E_{max} = E'\left[1 - \beta_{in}\right], \quad (49)$$

$$E_{min} = E'\left[1 - \alpha_{in}\right] \quad (50)$$

The relative energy losses (minimum and maximum) are

$$\beta_{in} = \left[\frac{A}{A+1}\cdot\frac{E_0^k}{E'} + \frac{\alpha}{2}\left(1 - \sqrt{1 - \frac{A+1}{A}\cdot\frac{E_0^k}{E'}}\right)\right], \quad (51)$$

$$\alpha_{in} = \left[\frac{A}{A+1}\cdot\frac{E_0^k}{E'} + \frac{\alpha}{2}\left(1 + \sqrt{1 - \frac{A+1}{A}\cdot\frac{E_0^k}{E'}}\right)\right]. \quad (52)$$

From expression (46) it is a simple matter to derive a link between the change in the cosine of the angle ($d\mu_c$) and the energy change dE corresponding to it:

$$dE = d\mu_c \cdot \frac{2A\cdot E'}{(A+1)^2}\cdot\sqrt{1 - \frac{A+1}{A}\frac{E_0^k}{E'}} = d\mu_c \cdot \frac{E'\alpha}{2}\sqrt{1 - \frac{A+1}{A}\cdot\frac{E_0^k}{E'}}. \quad (53)$$

From expressions (47) and (48) it will be seen that the neutron energy scatter due to losses associated with the recoil of the excited nucleus in inelastic scattering is

$$E_{max} - E_{min} = \frac{4A\cdot E'}{(A+1)^2}\cdot\sqrt{1 - \frac{A+1}{A}\cdot\frac{E_0^k}{E'}}, \quad (54)$$

and that the average energy loss in inelastic scattering can be derived from expressions (46), (47) and (48).

$$E' - \frac{E_{max} + E_{min}}{2} = \frac{A}{A+1}\cdot E_0^k\cdot\left[1 + \frac{2}{A+1}\cdot\frac{E'}{E_0^k}\right]. \quad (55)$$

The link between μ_L and μ_c is obtained from relationships (42) and (45):

$$\mu_L = \frac{1 + A\cdot\mu_c\sqrt{1 - \frac{A+1}{A}\cdot\frac{E_0^k}{E'}}}{\sqrt{1 + 2A\cdot\mu_c\cdot\sqrt{1 - \frac{A+1}{A}\cdot\frac{E_0^k}{E'}} + A^2\left(1 - \frac{A+1}{A}\cdot\frac{E_0^k}{E'}\right)}}. \quad (56)$$

Solving this equation for μ_c, we get

$$\mu_c = \frac{\overset{+}{(-)}\,\mu_L\sqrt{\mu_L^2 + A^2\left(1 - \frac{A+1}{A}\cdot\frac{E_0^k}{E'}\right) - 1} + \mu_L^2 - 1}{A\sqrt{1 - \frac{A+1}{A}\cdot\frac{E_0^k}{E'}}}. \quad (57)$$

From expression (57) it will be apparent that two different scattering angles in the centre-of-mass system can conform to a given cosine of the scattering angle in the laboratory system. However, this is by no means true every time, and if there is a unique relationship between μ_L and μ_C in formula (57) a plus sign should be inserted. Here and in what follows, therefore, the minus sign is placed in brackets.

The form of the scattering indicatrix in the laboratory system of co-ordinates $f(\mu_L)$ is determined from the condition of conservation of the scattering probability during the transition from one system of co-ordinates to the other:

$$f(\mu_L) \cdot d\mu_L = \frac{1}{2} d\mu_C; \tag{58}$$

or, making use of expression (57), we obtain

$$f(\mu_L) = \frac{1}{2} \frac{d\mu_C}{d\mu_L} = \frac{\left(\mu_L \pm \sqrt{\mu_L^2 + A^2\left(1 - \frac{A+1}{A} \cdot \frac{E_o^k}{E'}\right) - 1}\right)^2}{2A\sqrt{1 - \frac{A+1}{A} \cdot \frac{E_o^k}{E'}} \cdot \sqrt{\mu_L^2 + A^2\left(1 - \frac{A+1}{A} \cdot \frac{E_o^k}{E'}\right) - 1}}, \tag{59}$$

where $\frac{1}{2}d\mu_C$ is the scattering indicatrix in the centre-of-mass system. Again using expressions (42) and (45), we express the neutron energy after inelastic scattering by

$$E = E' \frac{2\mu_L + A^2\left(1 - \frac{A+1}{A} \cdot \frac{E_o^k}{E'}\right) - 1 \pm 2\mu_L\sqrt{\mu_L^2 + A^2\left(1 - \frac{A+1}{A} \cdot \frac{E_o^k}{E'}\right) - 1}}{(A+1)^2}. \tag{60}$$

It will be seen from expression (60) and from many of the other formulae set out above that inelastic scattering can occur only when

$$E' \geqslant E_o^k \frac{A+1}{A}, \tag{61}$$

where

$$E_{for} = E_o^k \cdot \frac{A+1}{A} \tag{62}$$

is called the forward threshold of the reaction. In fact, E_{for} is the minimum kinetic energy which must be imparted to the nucleus in inelastic scattering at a level of E_o^k for the escaping neutron to have a direction that is "strictly ahead" ($\vartheta_L = 0$) in the L system. We can check this by substituting $W = 0$ in expression (34), because in the C system the energy corresponding to E_{for} is equal to E_o^k, and the kinetic energy of the inelastically scattered neutron is zero. As a result we obtain relation (62) (i.e. $\frac{V'^2}{2} = E_o^k \frac{A+1}{A} = E_{for}$); from

equation (35) it follows that $\vec{V} = \vec{V}_c$, i.e. that the velocity of the neutron escaping after inelastic scattering in this case ($E' = E_{for}$) coincides in magnitude and direction with the velocity of the centre of mass ($\vartheta_L = 0$, $\mu_L = 1$).

Let us now consider how the angle of possible deflection of the inelastically scattered neutron changes with energy. For this purpose we determine the minimum value of μ_L from the condition that the derivative $\frac{d\mu_L}{dE'} = 0$ (cf. expression (45)):

$$\mu_L^{min} = (A+1)\sqrt{\frac{E_o^k}{E'}\frac{A}{A+1} - \frac{A-1}{A+1}}. \qquad (63)$$

It follows from expression (63) that when $E' > E_{for}$ the angle of maximum deflection of the neutron increases, and ultimately, at an energy of

$$E' = E_o^k \frac{A}{A-1}, \qquad (64)$$

reaches its limiting value of $\frac{\pi}{2}$ ($\mu_L = 0$). This means that at a neutron energy of

$$E_{rev} = E' = E_o^k \frac{A}{A-1} \qquad (65)$$

there cannot be any particle scattered at an angle ϑ_L greater than $\frac{\pi}{2}$; hence E_{rev} is called the reverse threshold of the reaction.

When $E' > E_{rev}$, there is no upper limit for ϑ_L (cf. Fig. 9a); neutrons in the laboratory system of co-ordinates can be observed at all angles (μ_L^{min} has no real value).

Let us examine two essentially different cases of scattering, corresponding to the above-mentioned regions of energy E':

I. $E_{for} \leqslant E' \leqslant E_{rev}$; and

II. $E' > E_{rev}$.

We shall determine what relationships between the velocity of the centre of mass (V_c) and the velocity of the scattered neutron observed in the C system (W) can exist in cases I and II.

From formula (34), substituting $E' = E_{rev} = \frac{A}{A-1} E_o^k$ for $\frac{V'^2}{2}$ and then making use of expression (28), we have

$$V_c = W$$

whence it follows that when $E' \leqslant E_{rev}$

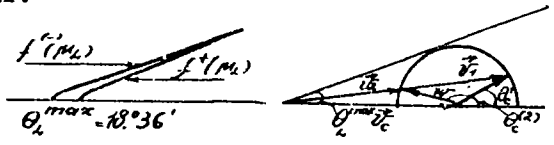
$$V_c \geqslant W \text{ (case I)},$$

and when $E' > E_{rev}$

$$V_c < W \text{ (case II).}$$

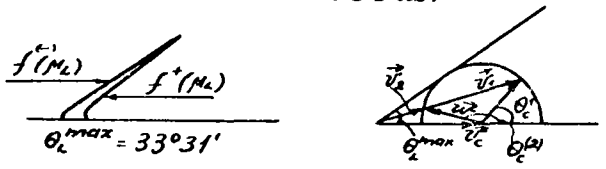
Figs 4 to 9 show polar velocity diagrams (4b-9b), and also the probabilities of an inelastically scattered neutron escaping at various angles in the laboratory system of co-ordinates (4a-9a) for the case of scattering which is spherically symmetrical in the centre-of-mass system. By way of example diagrams are shown which portray the inelastic scattering of neutrons at the E_o^k = 0.478 MeV level of the ^{7}Li nucleus, which were obtained from formulae (58) and (59). Figs 4 to 7 relate to E' values situated between the forward and reverse thresholds, Fig. 8 to $E' = E_{rev}$ and Fig. 9 to $E' > E_{rev}$. As can be seen from diagrams 4-7, in the first case $\{E_{for} < E' < E_{rev};\ V_c > W\}$ neutrons of two energies (velocities) are observed at each angle in the laboratory system of co-ordinates. Neutrons of the first group have a velocity of $\vec{V}_1$ (cf. Figs 4b to 7b) and are deflected as a result of inelastic scattering at an angle of $\vartheta_c^{(1)}$ in the C system. Neutrons of the second group have a velicity of $\vec{V}_2$ $(\vec{V}_2 < \vec{V}_1)$ and are deflected at an angle of $\vartheta_c^{(2)}$, which is larger than $\vartheta_c^{(1)}$.

E_{init} = 0.546 MeV E' = 0.547 MeV



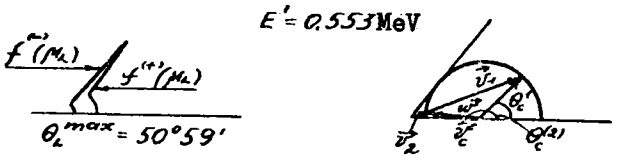
4a 4b

E' = 0.550 MeV



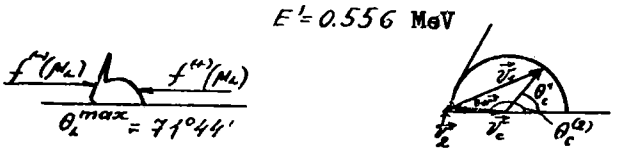
5a 5b

E' = 0.553 MeV



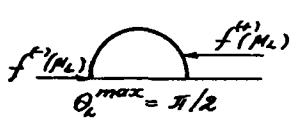
6a 6b

E' = 0.556 MeV

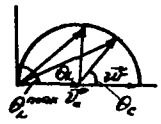


7a 7b

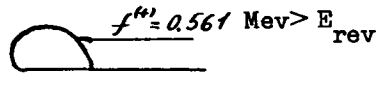
$E' = 0.557$ MeV $= E_{rev}$



8a



8b



9a

9b

The plus and minus sign in expressions (57), (59) and (60) correspond to the first and second groups of neutrons, respectively. The scattering angular distribution in this case consists of two branches, one of which corresponds to the "smaller" ϑ_C angles (the first group of neutrons) and has a larger scattering probability than the branch corresponding to the larger ϑ_C angles (second group of neutrons). When $E' = E_{rev}$, only one branch - relating to the first group of neutrons - remains: the minus sign in formulae (57), (59) and (60) should be omitted at this boundary energy value. It can be seen from Fig. 8 that when $E' = E_{rev}$ scattered neutrons are observed in the laboratory system of co-ordinates throughout the forward half space ($\vartheta_L^{"max"} = \frac{\pi}{2}$) and that for each angle ϑ_L there is one corresponding angle ϑ_C. By $\vartheta_C^{"max"}$ we shall denote an angle which in the C system corresponds to the angle $\vartheta_L^{"max"}$ in the laboratory system of co-ordinates. Whereas in case I all possible ϑ_L are comprehended between $\vartheta_L^{"max"}$ and $\vartheta_L = 0$, the angles corresponding to them in the C system are distributed between $\vartheta_C = 0°$ and $\vartheta_C = 180°$, the angles from $\vartheta_C = 0°$ to $\vartheta_C = \vartheta_C^{"max"}$ relating to the first group, and the angles from $\vartheta_C = \vartheta_C^{"max"}$ to $\vartheta_C = 180°$ relating to the second group of scattered neutrons. In other words, when $E' < E_{rev}$, all possible scattering angles in the C system will be included only when both the plus and minus signs are taken into account in formulae (57), (59) and (60).

It follows from Fig. 9 that in the second case $\{E' > E_{rev};\ V_c < W\}$ there are no limitations with respect to the scattering angle in the laboratory system of co-ordinates (as has already been mentioned above). In this case only the plus sign should be used in formulae (57), (59) and (60).

We shall also introduce some well-known relationships relating to elastic scattering and derived from the corresponding formulae obtained above for inelastic scattering (putting $E_o^k = 0$).

$$\mu_c = 1 - \frac{(A+1)^2}{2A}\left[1 - \frac{E}{E'}\right] \quad ; \qquad (42')$$

$$\mu_L = \frac{A+1}{2}\sqrt{\frac{E}{E'}} - \frac{A-1}{2}\sqrt{\frac{E'}{E}} \quad ; \qquad (45')$$

$$E = E'\left[1 - \frac{2A}{(A+1)^2}(1-\mu_c)\right] \quad ; \qquad (46')$$

$$E_{max} = E' \qquad \text{(when } \mu_C = 1\text{)} \qquad (47')$$

$$E_{min} = E'\left[1 - \frac{4A}{(A+1)^2}\right] = E'(1-\alpha) \qquad \text{(when } \mu_C = -1\text{)} \qquad (48')$$

α_{in} becomes $\alpha = \frac{4A}{(A+1)^2}$; (52')

β_{in} becomes equal to zero; (51')

$$dE = \frac{2AE'}{(A+1)^2}\, d\mu_c = \frac{\alpha}{2}\, d\mu_c \quad ; \qquad (53')$$

$$\mu_L = \frac{1 + A\mu_c}{\sqrt{1 + 2A\mu_c + A^2}} \quad ; \qquad (56')$$

$$\mu_c = \frac{\mu_L\sqrt{A^2 - 1 + \mu_L^2} + \mu_L^2 - 1}{A} \quad ; \qquad (57')$$

$$f(\mu_L) = \frac{\left(\mu_L + \sqrt{A^2 - 1 + \mu_L^2}\right)^2}{2A\sqrt{A^2 - 1 - \mu_L^2}} \quad ; \qquad (59')$$

$$E = E'\,\frac{2\mu_L^2 + A - 1 + 2\mu_L\sqrt{\mu_L^2 + A^2 - 1}}{(A+1)^2} \qquad (60')$$

In the last three formulae the minus sign is omitted in the numerator in front of the root as elastic scattering is not a threshold reaction and the case of ambiguity in the determination of $\mu_C(\mu_L)$, $f(\mu_L)$ and $E(\mu_L)$ does not arise.

4. Calculation of the slowing down matrix

In accordance with what has been set out in section 1 (cf. expression (5)) and in section 2 (cf. expression (17)), we shall write the ℓth moment of the inelastic scattering angular distribution from group i with the boundaries E_i and E_{i-1} in group j with the boundaries E_j and E_{j-1} (where $i \leqslant j$, $E_i < E_{i-1}$ and $E_j < E_{j-1}$):

$$W_{\ell(in)}^{i\to j} = \frac{G_{in,\ell}^{i\to j}}{G_{in}^{i}} \qquad (66a)$$

where σ_{in}^{i} is the average group inelastic scattering cross-section:

$$\sigma_{in}^{i} = \frac{\int_{E_i}^{E_{i-1}} \sigma_{in}(E') \cdot F_0(E') \cdot dE'}{\int_{E_i}^{E_{i-1}} F_0(E') \cdot dE'} \quad ;$$

$$W_{\ell(in)}^{i \to j} = \frac{\sum_{k=1}^{K} \int_{\tilde{E}_i}^{\tilde{E}_{i-1}} \int_{\tilde{E}_j}^{\tilde{E}_{j-1}} \sigma_{in}(E') \cdot S_\ell(E' \to E, E_0^k) \cdot F_\ell(E') \cdot dE' \cdot dE}{\int_{E_i}^{E_{i-1}} F_\ell(E') \cdot dE' \cdot \int_{E_i}^{E_{i-1}} \sigma_{in}(E') \cdot F_0(E') \cdot dE' \Big/ \int_{E_i}^{E_{i-1}} F_0(E') \cdot dE'} =$$

$$= \frac{\sum_{k=1}^{K} \int_{\tilde{E}_i}^{\tilde{E}_{i-1}} \int_{\tilde{E}_j}^{\tilde{E}_{j-1}} \sigma_{in}(E') \cdot S_\ell(E' \to E, E_0^k) \cdot F_\ell(E') \cdot dE' \cdot dE}{q_\ell \cdot \int_{E_i}^{E_{i-1}} \sigma_{in}(E') \cdot F_0(E') \cdot dE'} . \qquad (66)$$

Here

$$q_\ell = \frac{\int_{E_i}^{E_{i-1}} F_\ell(E') \cdot dE'}{\int_{E_i}^{E_{i-1}} F_0(E') \cdot dE'}$$

$\tilde{E}_i$ and $\tilde{E}_{i-1}$ are the limits of the energy region in group i from which scattering into group j is possible; $\tilde{E}_j$ and $\tilde{E}_{j-1}$ are the limits of the region in group j which can be hit by neutrons scattered from group i; and $S_\ell^{in}(E' \to E, E_0^k)$ is the ℓth moment of the inelastic scattering angular distribution at level E_0^k, which (in accordance with our analysis in section 1) we determine as the ratio of the differential cross-section $\sigma_{in}(E' \to E, E_0^k, \mu_L)$ to the total cross-section for inelastic scattering when $E' - \sigma_{in}(E')$:

$$S_{in}'(E' \to E, E_0^k, \mu_L) = \sigma_{in}(E' \to E, E_0^k, \mu_L) \Big/ \sigma_{in}(E'), \qquad (67)^{*/}$$

In order to calculate $W_{\ell(in)}^{i \to j}$ it is first necessary to find an expression for the scattering angular distribution S_{in}, which is convenient for integration, and then also for its moments.

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*/ Here the index of the element of the medium is omitted as only the micro-cross-section is considered.

Since the neutron energy after collision is uniquely determined by the deflection of the neutron from its initial direction as observed in the centre-of-mass system of co-ordinates (at given values of E', E_o^k and A - see expression (46)), the differential cross-section and consequently also the scattering description must contain a δ-function ensuring the fulfilment of relation (46), i.e. linking the energy before and after scattering. This can obviously be done with the help of the following δ-function:

$$\delta\left(E-E'\left[1-\frac{2A}{(A+1)^2}\left(1+\frac{A+1}{2}\cdot\frac{E_o^k}{E'}-\mu_c\sqrt{1-\frac{A+1}{A}\cdot\frac{E_o^k}{E'}}\right)\right]\right) \qquad (68)$$

Apart from this δ-function, the scattering description must also contain a cross-section and angular distribution for neutrons (for our purposes it is desirable to use an angular distribution in the laboratory system of co-ordinates).

For inelastic scattering at the level E_o^k, which is anisotropic in the centre-of-mass system, the probability of deflection at the scattering angle ϑ_C is determined by the differential cross-section $\sigma(E', E_o^k, \mu_C)$, which corresponds to the cross-section $\sigma(E', E_o^k, \mu_L)$ in the laboratory system. We shall represent the differential cross-section in the form of an expansion in Legendre polynomials; then, following the law of conservation of the number of particles, we have

$$\sigma_{in}(E', E_o^k, \mu_c)\,d\mu_c = \sigma_{in}(E', E_o^k, \mu_L)\,d\mu_L\,, \qquad (69)$$

and we determine $\sigma_{in}(E', E_o^k, \mu_L)$ as

$$\sigma_{in}(E', E_o^k, \mu_L) = \frac{\sigma_{in}(E', E_o^k)}{4\pi}\sum_{m=0}^{\infty}\omega_m^L(E')\,P_m(\mu_L) = \frac{\sigma_{in}(E', E_o^k)}{4\pi}\sum_{m=0}^{\infty}\omega_m^c(E')\,P_m(\mu_L)\frac{d\mu_c}{d\mu_L} \qquad (70)$$

where

$$\omega_m^L(E') = 4\pi\cdot\frac{2m+1}{2}\cdot\frac{\int_{-1}^{+1}\sigma_{in}(E', \mu_L)\cdot P_m(\mu_L)\cdot d\mu_L}{\sigma_{in}(E')} =$$

$$= (2m+1)\cdot\frac{\int_{-1}^{+1}\sigma_{in}(E', \mu_L)\cdot P_m(\mu_L)\cdot d\mu_L}{\int_{-1}^{+1}\sigma_{in}(E', \mu_L)\cdot d\mu_L}$$

Hence, in the case of inelastic scattering, which is anistropic in the centre-of-mass system, the scattering angular distribution at the level E_o^k will take the form

$$S_{in}(E'\to E, E_o^k, \mu_L) = \sigma_{in}(E'\to E, E_o^k, \mu_L)\Big/\sigma_{in}(E') =$$

$$= \frac{\sigma_{in}(E', E_o^k)}{4\pi\cdot\sigma_{in}(E')}\sum_{m=0}^{\infty}\omega_m^L(E')\cdot P_m(\mu_L)\cdot\delta\left(E-E'\left[1-\frac{2A}{(A+1)^2}\left(1+\frac{A+1}{2}\cdot\frac{E_o^k}{E'}-\mu_c\sqrt{1-\frac{A+1}{A}\cdot\frac{E_o^k}{E'}}\right)\right]\right). \qquad (71)$$

Here we use a δ-function which is dependent on μ_C, and this greatly simplifies the subsequent integration.

Let us now represent the scattering angular distribution - expression (71) - as an expansion in Legendre polynomials and derive the coefficients of this expansion:

$$S'_{in}(E' \to E, E_o^k, \mu_L) = \frac{1}{4\pi} \sum_{\ell=0}^{\infty} S'^{in}_{\ell}(E' \to E, E_o^k) \cdot P_\ell(\mu_L), \tag{72}$$

where

$$S'^{in}_{\ell}(E' \to E, E_o^k) = 2\pi(2\ell+1) \int_{-1}^{+1} S'_{in}(E' \to E, E_o^k, \mu_L) \cdot P_\ell(\mu_L) \cdot d\mu_L. \tag{73}$$

In expression (73) we then introduce the value of the scattering angular distribution from Eq. (71) in place of the integrand.

$$S'^{in}_{\ell}(E' \to E, E_o^k) = 2\pi(2\ell+1) \int_{-1}^{+1} \frac{G_{in}(E', E_o^k)}{4\pi \cdot G_{in}(E')} \cdot \left(\sum_{m=0}^{\infty} \omega_m^L(E') \cdot P_m(\mu_L) \right) \cdot P_\ell(\mu_L) \cdot \delta\left[E - E' \left[1 - \frac{2A}{(A+1)^2} \left(1 + \frac{A+1}{2} \frac{E_o^k}{E'} - \mu_C \sqrt{1 - \frac{A+1}{A} \frac{E_o^k}{E'}} \right) \right] \right] d\mu_L. \tag{74}$$

We multiply and divide the integrand by $d\mu_C$ and undertake the following substitution of variables:

$$x = \frac{2AE'}{(A+1)^2} \mu_C \sqrt{1 - \frac{A+1}{A} \frac{E_o^k}{E'}}; \quad d\mu_C = dx \Big/ \frac{2AE'}{(A+1)^2} \sqrt{1 - \frac{A+1}{A} \cdot \frac{E_o^k}{E'}}$$

$$S'^{in}_{\ell}(E' \to E, E_o^k) = (2\ell+1) \cdot \int_{-\frac{2AE'}{(A+1)^2} \sqrt{1 - \frac{A+1}{A} \frac{E_o^k}{E'}}}^{+\frac{2AE'}{(A+1)^2} \sqrt{1 - \frac{A+1}{A} \frac{E_o^k}{E'}}} \frac{G_{in}(E', E_o^k)}{2 \cdot G_{in}(E')} \left(\sum_{m=0}^{\infty} \omega_m^L(E') \cdot P_m(\mu_L) \right) \cdot P_\ell(\mu_L) \cdot \delta\left(E + \frac{A}{A+1} E_o^k - E' + \frac{2AE'}{(A+1)^2} - x \right) \cdot dx \frac{d\mu_L}{d\mu_C} \Big/ \frac{2AE'}{(A+1)^2} \sqrt{1 - \frac{A+1}{A} \frac{E_o^k}{E'}}, \tag{75}$$

where $\frac{2A}{(A+1)^2} = \frac{\alpha}{2}$, and $\frac{d\mu_L}{d\mu_C}$ is determined by relation (57). In expressions (74), (75) and (57) μ_L is a function of the initial (E') and final (E) neutron energies and is determined by relation (45).

Hence the coefficients for the expansion in Legendre polynomials of the inelastic scattering angular distribution, which is anisotropic in the centre-of-mass system, take the following form:

$$S'^{in}_{\ell}(E' \to E, E_o^k) = \frac{(2\ell+1) \cdot G_{in}(E', E_o^k)}{\alpha \cdot E' \sqrt{1 - \frac{A+1}{A} \frac{E_o^k}{E'}} \cdot G_{in}(E')} \cdot \left(\sum_{m=0}^{\infty} \omega_m^L(E') \cdot P_m(\mu_L) \right) \cdot \frac{d\mu_L}{d\mu_C}. \tag{76}$$

It will be seen that the expansion coefficients $S^{in}_{\ell}(E' \to E, E^k_o)$ are themselves dependent on the expansion parameter μ_L. The reason for this

is that there exists a relation between μ_L and E determined by expression (45). We shall bear this in mind below in selecting the limits of integration in expression (66).

The applicability of formula (76) is determined by the energy which a neutron can possess as a result of inelastic scattering. This indicates that the coefficients $S_\ell^{in}(E' \to E, E_o^k)$ are meaningful for an energy E from the region

$$E'\left[1-\frac{\alpha}{2}\left(1+\frac{A+1}{2}\frac{E_o^k}{E'}+\sqrt{1-\frac{A+1}{A}\frac{E_o^k}{E'}}\right)\right] \leqslant E \leqslant E'\left[1-\frac{\alpha}{2}\left(1+\frac{A+1}{2}\frac{E_o^k}{E'}-\sqrt{1-\frac{A+1}{A}\frac{E_o^k}{E'}}\right)\right], \tag{77}$$

or

$$E'(1-\alpha_{in}) \leqslant E \leqslant E'(1-\beta_{in}).$$

For energies higher than $E'(1-\beta_{in})$ and less than $E'(1-\alpha_{in})$, $S_\ell^{in}(E' \to E, E_o^k)$ are equal to zero.

As in expression (76), we can write the coefficients for an expansion in Legendre polynomials of the elastic scattering angular distribution, which is anisotropic in the centre-of-mass system, as

$$S_\ell^e(E' \to E) = \frac{(2\ell+1)\cdot\sigma_e(E')\cdot P_\ell(\mu_L)}{\alpha\cdot E'\cdot\sigma_e(E')}\cdot\left(\sum_{m=0}^{\infty}\omega_m^L(E')\cdot P_m(\mu_L)\right)\cdot\frac{d\mu_L}{d\mu_c}. \tag{78}$$

It is apparent that the region for the determination of these coefficients will be included within the limits $E'(1-\alpha) \leqslant E \leqslant E'$.

Let us revert to expression (66) for the ℓth moment of the angular distribution of inelastic scattering from group i into group j, substituting the value derived from expression (76) for $S_\ell^{in}(E' \to E, E_o^k)$. We write the equation as follows:

$$W_{\ell(in)}^{i\to j} = \frac{\sum_{k=1}^{K}(2\ell+1)\int_{\tilde{E}_i}^{\tilde{E}_{i-1}}\sigma_{in}(E')\frac{\sigma_{in}(E',E_o^k)}{\sigma_{in}(E')\cdot\alpha\cdot E'}\cdot F_\ell(E')\,dE'\int_{\tilde{E}_j}^{\tilde{E}_{j-1}}P_\ell(\mu_L)\cdot\left(\sum_{m=0}^{\infty}\omega_m^L(E')\cdot P_m(\mu_L)\right)\cdot\frac{\frac{d\mu_L}{d\mu_c}\cdot dE}{\sqrt{1-\frac{A+1}{A}\cdot\frac{E_o^k}{E'}}}}{q_\ell\int_{E_i}^{E_{i-1}}\sigma_{in}(E')\cdot F_o(E')\cdot dE'}, \tag{79}$$

The ℓth moment of the cross-section of inelastic neutron scattering from group i to group j is

$$\sigma_{in,\ell}^{i\to j} = \frac{W_{\ell(in)}^{i\to j}\cdot\int_{E_i}^{E_{i-1}}\sigma_{in}(E')\cdot F_o(E')\cdot dE'}{\int_{E_i}^{E_{i-1}}F_o(E')\cdot dE'} = W_{\ell(in)}^{i\to j}\cdot\sigma_{in}^{i}. \tag{80}$$

For convenience in calculating the group parameters for anisotropy, the variables in formula (79) can be replaced with the help of expression (53), which links the values dE and $d\mu_C$; as a result we obtain for $W_{\ell}^{i\to j}(in)$ the following expression:

$$W_{\ell(in)}^{i\to j}=\sum_{k=1}^{K}\frac{(2\ell+1)\sum_{m=0}^{\infty}\int_{\tilde{E}_i}^{\tilde{E}_{i-1}}\sigma_{in}(E',E_o^k)\cdot\omega_m^L(E')\cdot F_\ell(E')\,dE'\int_{\mu_L(\tilde{E}_j,E')}^{\mu_L(\tilde{E}_{j-1},E')}P_\ell(\mu_L)\cdot P_m(\mu_L)\,d\mu_L}{2q_\ell\int_{E_i}^{E_{i-1}}\sigma_{in}(E)\cdot F_o(E)\,dE},\qquad(81)$$

where $\mu_L(\tilde{E}_{j-1},E')$ and $\mu_L(\tilde{E}_j,E')$ are calculated by means of formula (45).

Before proceeding to a direct determination of the limits of integration in expression (81), we shall consider the value $W_{\ell}^{\to j}(E')$, which characterizes the ℓth moment of the probability of inelastic scattering of a neutron with energy E', at the E_o^k level into group j. Then formula (81) is written as

$$W_{\ell(in)}^{i\to j}=\sum_{k=1}^{K}\frac{\int_{\tilde{E}_i}^{\tilde{E}_{i-1}}\sigma_{in}(E',E_o^k)\cdot F_\ell(E')\cdot W_\ell^{\to j}(E')\,dE'}{q_\ell\int_{E_i}^{E_{i-1}}\sigma_{in}(E')\cdot F_o(E')\,dE'},\qquad(82)$$

where

$$W_\ell^{\to j}(E')=\frac{2\ell+1}{2}\sum_{m=0}^{\infty}\omega_m^L(E')\int_{\mu_L(\tilde{E}_j,E')}^{\mu_L(\tilde{E}_{j-1},E')}P_\ell(\mu_L)\cdot P_m(\mu_L)\cdot d\mu_L.\qquad(83)$$

The limits of integration in the numerator of expression (81) depend on the atomic weight of the nucleus with which the interaction occurs, and on the width and relative position of groups i and j. In calculating the limits, therefore, we shall be interested in knowing what energy E' the neutron had if as a result of inelastic scattering at the level E_o^k with a minimum (or maximum) energy loss the neutron acquired a given energy E. In the first case (minimum energy loss), we shall denote the corresponding E' by $E'_{min}(E)$, and in the second case (maximum loss) by $E'_{max}(E)$, and we obtain these values by solving expressions (47) and (48) for E':

$$E'_{min}(E)=\frac{1}{(1-\alpha)}\left\{\left[\left(E+\frac{E_o^kA}{A+1}\right)\left(1-\frac{\alpha}{2}\right)-\frac{E_o^k\alpha}{2(A+1)}\right]-\sqrt{\left[\left(E+\frac{E_o^kA}{A+1}\right)\left(1-\frac{\alpha}{2}\right)-\frac{E_o^k\alpha}{2(A+1)}\right]^2-\left(E+\frac{E_o^kA}{A+1}\right)^2(1-\alpha)}\right\}\qquad(84)$$

$$E'_{max}(E)=\frac{1}{(1-\alpha)}\left\{\left[\left(E+\frac{E_o^kA}{A+1}\right)\left(1-\frac{\alpha}{2}\right)-\frac{E_o^k\alpha}{2(A+1)}\right]+\sqrt{\left[\left(E+\frac{E_o^kA}{A+1}\right)\left(1-\frac{\alpha}{2}\right)-\frac{E_o^k\alpha}{2(A+1)}\right]^2-\left(E+\frac{E_o^kA}{A+1}\right)^2(1-\alpha)}\right\}.\qquad(85)$$

Here $\alpha = \frac{4A}{(A+1)^2}$ is the relative maximum energy loss in elastic scattering. With the help of $E'_{min}(E)$ and $E'_{max}(E)$ it is a simple matter to determine the energy region from which scattering into group j is possible. As can easily be seen from Fig. 10, this will be the region $E'_{min}(E_j) - E'_{max}(E_{j-1})$:

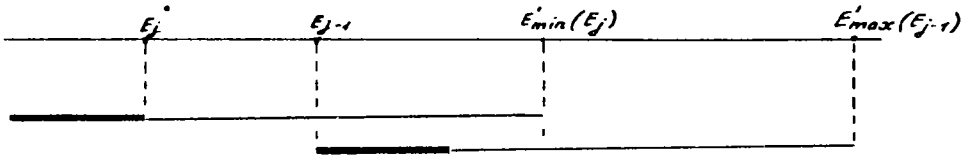


Fig. 10

In Fig. 10 the black lines indicate the region in which neutrons of the energies mentioned can be scattered. $E'_{min}(E_j)$ is the smallest of all possible energies at which, as a result of inelastic scattering, a neutron can appear in group j. In fact, if $E' = E'_{min}(E_j)$, then only at minimum loss will the energy of the scattered neutron become E_j; in all other cases scattering will go beyond the bounds of group j. But if the initial energy of the neutron is less than $E'_{min}(E_j)$, then at any energy loss scattering will go beyond the boundaries of group j. $E'_{max}(E_{j-1})$ is the largest of all possible energies at which the neutron can be scattered into group j. In fact, if the initial energy of the neutron is greater than $E'_{max}(E_{j-1})$, then the scattered neutron will not pass into group j no matter what the energy loss is. Below we shall be interested in scattering from some particular group i into the group j under consideration. Depending on the position of group i with respect to the region $E'_{min}(E_j) - E'_{max}(E_{j-1})$, from which scattering into group j is possible, five different cases are possible.

1. Group i lies wholly within the region $E'_{min}(E_j) - E'_{max}(E_{j-1})$, that is

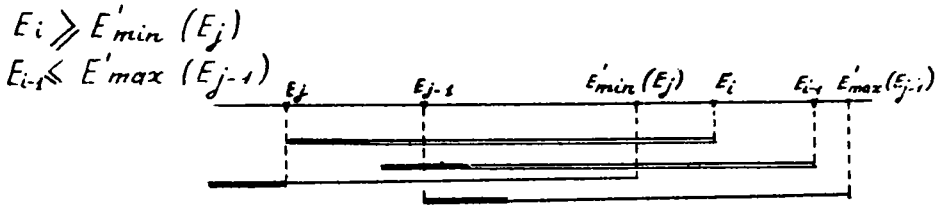


Fig. 11

It is apparent that in this case any neutron from group i can appear in group j as a result of scattering.

2. The upper limit $E'_{max}(E_{j-1})$ of the range from which scattering into group j is possible lies within group i and the lower limit $E'_{min}(E_j)$ lies outside the limits of group i, that is

$$E_i \geqslant E'_{min}(E_j)$$
$$E_{i-1} \geqslant E'_{max}(E_{j-1}).$$

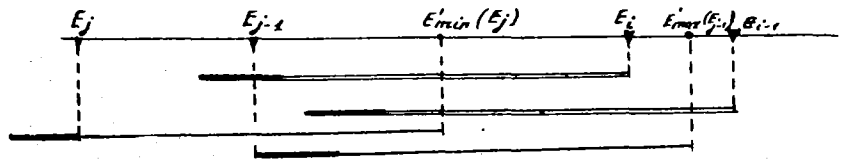


Fig. 12

In this case only neutrons from the energy range $E_i - E'_{max}(E_{j-1})$ of group i can pass into group j. No neutron having an energy higher than $E'_{max}(E_{j-1})$ can reach group j.

3. The lower boundary $E'_{min}(E_j)$ of the range from which scattering into group j is possible lies within group i, and the upper boundary $E'_{max}(E_{j-1})$ lies outside the boundaries of group i, that is

$$E_i \leqslant E'_{min}(E_j)$$
$$E_{i-1} \leqslant E'_{max}(E_{j-1}).$$

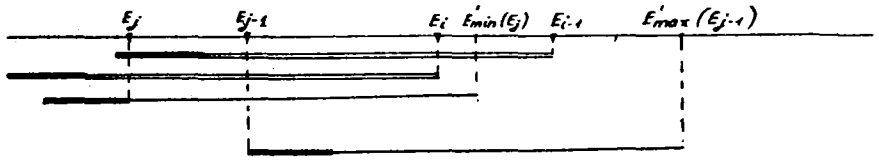


Fig. 13

In this case only neutrons from the range $E'_{min}(E_j) - E_{i-1}$ of group i can be scattered into group j. All neutrons having energies lower than $E'_{min}(E_j)$ pass through group j as a result of scattering.

4. The group encompasses the whole range $E'_{min}(E_j) - E'_{max}(E_{j-2})$, that is

$$E_i \leqslant E'_{min}(E_j)$$
$$E_{i-1} \geqslant E'_{max}(E_{j-1}).$$

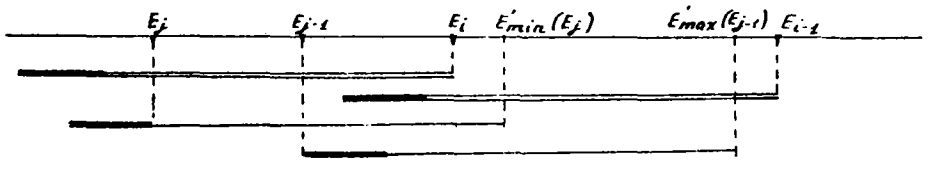


Fig. 14

It is apparent that in this case only neutrons from the region $E'_{min}(E_j)$ - $E'_{max}(E_{j-1})$ of group i can be scattered into group j.

5. Group i is entirely outside the region $E'_{min}(E_j) - E'_{max}(E_{j-1})$:

$$E_i \geqslant E'_{max}(E_{j-1})$$
$$E_{i-1} \geqslant E'_{max}(E_{j-1}).$$

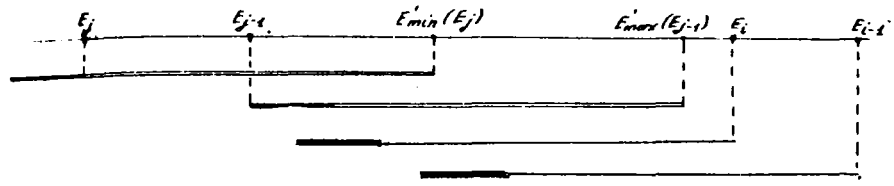


Fig. 15

It is clear that in this case no neutrons from group i will pass into group j.

On the basis of the above, we may conclude that in the most general case the limits of the region of group i from which scattering into group j can occur will be determined as follows:

$$\begin{aligned} \widetilde{E}_i &= \max \left[E'_{min}(E_j);\ E_i \right] \\ \widehat{E}_{i-1} &= \min \left[E_{i-1},\ E'_{max}(E_{j-1}) \right]. \end{aligned} \tag{84}$$

Let us examine the energy dependence of the functions $\vec{W}_\ell^{\,j}(E')$ (cf. formula (83)) and consider the probability of a neutron of energy E' passing into group j as a result of inelastic scattering, i.e. taking as an example the function $\vec{W}_0^{\,j}(E')$. The values of the limits of integration for other values of $\vec{W}_\ell^{\,j}(E')$, as can be seen from expression (83), will be the same.

Two cases of scattering should be distinguished.

1. The energy spread of inelastically scattered neutrons is always smaller than the width of group j: $E'(\alpha_{in} - \beta_{in}) < (E_{j-1} - E_j)$ for all values of E' from which transition into group j is possible.

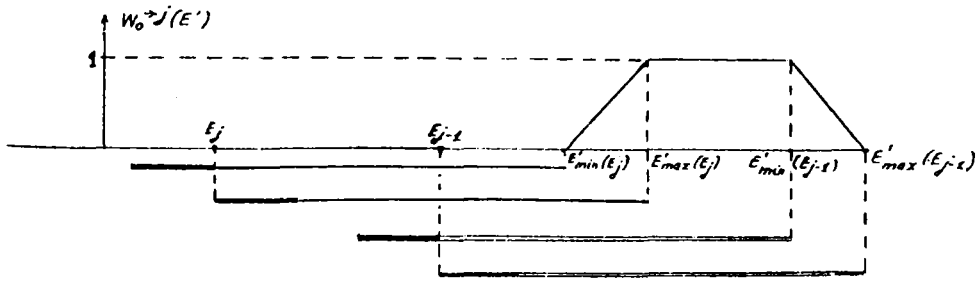


Fig. 16

It is obvious that for E' from the region $E'_{min}(E'_{j-1}) - E'_{max}(E_{j-1})$, $W_\ell^{i\to j}$ should be calculated by means of formula (82), with the limits

$$\left.\begin{aligned}\tilde{E}_j &= E'(1-\alpha_{in})\\ \tilde{E}_{j-1} &= E_{j-1}\end{aligned}\right\}. \qquad (I)$$

Neutrons from the region $E'_{max}(E_j) - E'_{min}(E_{j-1})$ reach group j after inelastic scattering with a probability equal to unity. Consequently $W_\ell^{i\to j}$ should be calculated for this region by means of formula (82), with the limits

$$\left.\begin{aligned}\tilde{E}_j &= E'(1-\alpha_{in})\\ \tilde{E}_{j-1} &= E'(1-\beta_{in})\end{aligned}\right\}. \qquad (II)$$

Finally, for E' from the region $E'_{min}(E_j) - E'_{max}(E_j)$, $W_\ell^{i\to j}$ is calculated by means of formula (82), with the limits

$$\left.\begin{aligned}\tilde{E}_j &= E_j\\ \tilde{E}_{j-1} &= E'(1-\beta_{in})\end{aligned}\right\}. \qquad (III)$$

2. The energy spread of inelastically scattered neutrons is wider than or equal to the width of group j:

$$E'(\alpha_{in} - \beta_{in}) \geq (E_{j-1} - E_j)$$

for all values of E' from which a transition to group j is possible.

In the range $E'_{min}(E_j) - E'_{min}(E_{j-1})$ we calculate $W_\ell^{\to j}(E')$ with the limits defined under (III), while in the range $E'_{max}(E_j) - E'_{max}(E_{j-1})$, the limits defined under (I) are adopted. In the range $E'_{min}(E_{j-1}) - E'_{max}(E_j)$, $W_\ell^{\to j}(E')$ is calculated within the limits

$$\left.\begin{aligned}\tilde{E}_j &= E_j\\ \tilde{E}_{j-1} &= E_{j-1}\end{aligned}\right\}. \qquad (IV)$$

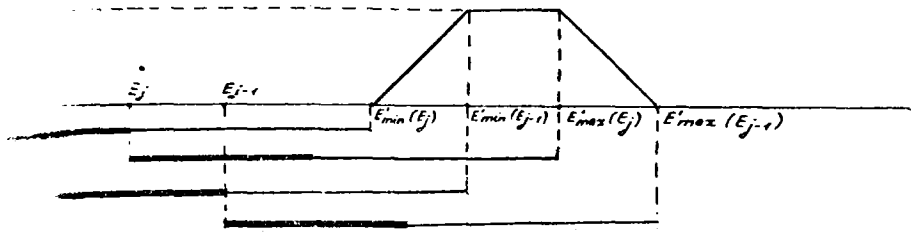


Fig. 17

When calculating parameters for the anisotropy of the transition from group i to group j, we must first determine which of the two cases mentioned above holds true. To do this we calculate the energies $E'_{min}(E_j)$, $E'_{max}(E_j)$, $E'_{min}(E_{j-1})$ and $E'_{max}(E_{j-1})$. If it is found that $E'_{max}(E_j) < E'_{min}(E_{j-1})$, the first case holds; if $E'_{max}(E_j) \geq E'_{min}(E_{j-1})$, the second case is true.

In addition, it is necessary to consider the position of group i in relating to the energies $E'_{min}(E_j)$, $E'_{max}(E_j)$, $E'_{min}(E_{j-1})$ and $E'_{max}(E_{j-1})$. We shall number these energies in order of increase:

$E_1 = E'_{min}(E_j)$

$E_2 = E'_{max}(E_j)$ in case 1 $\qquad$ $E_2 = E_{min}(E_{j-1})$ in case 2

$E_3 = E'_{min}(E_{j-1})$ in case 1 $\qquad$ $E_3 = E'_{max}(E_j)$ in case 2

$E_4 = E'_{max}(E_{j-1})$

For each of the boundaries of group i there are five possible positions relative to the energies noted above. The position of E_i is determined by the lower limit of $\tilde{E}_i$ of the energy region in group i from which transition to group j is possible; the position of E_{i-1} is determined by the upper limit of this region, $\tilde{E}_{i-1}$.

All possible positions of E_i and E_{i-1} relative to regions from which the scattering of neutrons into group j is possible are set out in Table 1, where the corresponding values of $\tilde{E}_i$ and $\tilde{E}_{i-1}$ are also given (if the transition from group i to group j is possible).

Table 1

Case No. m	Condition for E_i	$\tilde{E}_i$	Case No. n	Condition for E_{i-1}	$\tilde{E}_{i-1}$
1	$E_i < E_1$ $(n<5)$	$\tilde{E}_i = E_1$	1	$E_{i-1} \geq E_4$	$\tilde{E}_{i-1} = E_4$ (if $m<5$)
2	$E_1 \leq E_i < E_2$ $(n<4)$	$\tilde{E}_i = E_i$	2	$E_4 > E_{i-1} \geq E_3$ $(m<4)$	$\tilde{E}_{i-1} = E_{i-1}$
3	$E_2 \leq E_i < E_3$ $(n<3)$		3	$E_3 > E_{i-1} \geq E_2$ $(m<3)$	
4	$E_3 \leq E_i < E_4$ $(n<2)$		4	$E_2 > E_{i-1} \geq E_1$ $(m<2)$	
5	$E_i \geq E_4$	transition impossible	5	$E_{i-1} < E_1$	transition impossible

The combinations of conditions for E_i and for E_{i-1} determine the variant positions of group i relative to the region of possible transition of neutrons into group j. The number of these variants is 15:10 {m,n} combinations

in which $m + n = 6$ cannot occur because they would contradict the condition $E_{i-1} > E_i$ which follows from the determination of the group boundaries given at the beginning of Section 4. The variants $\{5,1\}$ and $\{1,5\}$ correspond to cases in which transition from group i to group j is impossible (where $m = 5$ $(E_i \geqslant E_4)$ all neutrons from group i fail to reach group j after scattering, and where $n = 5$ $(E_i \leqslant E_i)$ they pass through it - cf. diagrams in Table 2). As a result 13 cases remain. As in nine of these there are two possible variants of the formula for calculating $W_\ell^{\rightarrow j}(E')$ (depending on the relationship of $E'_{max}(E_j)$ and $E'_{min}(E_{j-1})$), 22 cases are possible in all for the transition variant which may hold in inelastic scattering from group i to group j. The probability $W_\ell^{\rightarrow j}(E')$ of these transitions is calculated by means of formula (83), with the integration limits given by formulae I-IV. Which of these formulae should be used and for what energy region in group i is indicated in Table 2 for each of the possible transitions. Table 2 also shows schematically the position of group i relative to the region from which transition of neutrons into group j is possible. All transition variants contained in Table 2 are represented schematically in Figs 18-39, which show both the probabilities $W^{\rightarrow j}(E')$ and the energy regions into which neutrons can be scattered. Each transition variant has a number corresponding to Table 2, with the indication "I" or "II", depending on the relationship between $E'_{max}(E_j)$ and $E'_{min}(E_{j-1})$.

Also indicated are the variants which can occur in elastic scattering and those corresponding to neutron scattering within the limits of a particular group.

As regards the development of the logic in the programme for calculating $\sigma_{in,\ell}^{i\rightarrow j}$, it is more convenient to leave Table 2 aside and use the equivalent Table 3, in which the limits of integration are shown explicitly for each integration interval within the energy region in group i from which a transition to group j is possible. Table 3 can be used for both inelastic and elastic scattering. However, with elastic scattering only case II of the variants $\{3.3\}$, $\{1.3\}$, $\{2.3\}$, $\{2.4\}$ and $\{1.4\}$ can occur in slowing down to the next lower group, and the variants $\{3.1\}$ and $\{4.1\}$ in scattering which leaves the neutron in the same group. Moreover, the formulae for calculating the limits have been considerably simplified. For that reason we include Table 4, which is similar to Table 3 but relates only to the case of elastic scattering.

In practical calculations of inelastic scattering at levels, a preliminary calculation of the maximum and minimum possible energies of neutrons scattered from group i may prove useful. Obviously, the maximum energy will be $(1 - \beta_{in}) \times E_{i-1}$, where β_{in} is a function of the initial

energy, in our case E_{i-1}. The highest lower boundary E_k among the boundaries of the groups considered must satisfy the condition

$$E_k < [1 - \beta_{in}(E_{i-1})] \times E_{i-1}$$

Group k will also be the first group to which a transition from group i is possible in the case of inelastic scattering at a given level.

In a similar way we determine the number of the lowest-energy group to which inelastic scattering from group i is possible. The lower limit for this group, E_m, is the maximum of all the lower limits of the groups considered which satisfy the condition

$$E_m < [1 - \alpha_{in}(E_i)] \times E_i$$

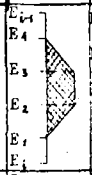
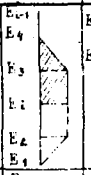
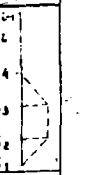
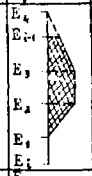
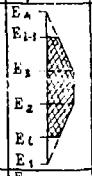
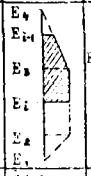
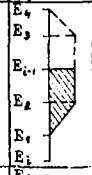
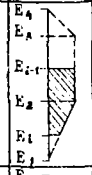
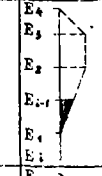
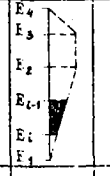
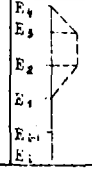
In conclusion we might mention that at the present time, in view of the absence of systematized data on the anisotropy of inelastic scattering, one frequently has to assume in calculating the parameters for anisotropy of inelastically scattered neutrons that inelastic scattering in the centre-of-mass system is isotropic. This means that all $\omega_m^c(E')$ except ω_o^c are zero, while ω_o^c in an expansion of type given in expression (70) is equal to unity. In this case relation (70) may be written as:

$$G(E', E_o^k, \mu_L) = \frac{G(E', E_o^k)}{4\pi} \sum_{m=0}^{\infty} \omega_m^L(E') \cdot P_m(\mu_L) = \frac{G(E', E_o^k)}{4\pi} \cdot \frac{d\mu_c}{d\mu_L} \qquad (85)$$

TABLE 2

Location of E_j when the position of E_{j-1} is fixed

Location of E_{j-1} when the position of E_1 is fixed

	1			2			3			4			5		
	Region E'	Conditions for the determination of E_j and E_{j-1}		Region E'	Conditions for the determination of E_j and E_{j-1}		Region E'	Conditions for the determination of E_j and E_{j-1}		Region E'	Conditions for the determination of E_j and E_{j-1}		Region E'	Conditions for the determination of E_j and E_{j-1}	
1	$E_{i-1} \leqslant E' < E_4$ $E_4 \leqslant E' < E_3$ $E_3 \leqslant E' < E_2$ $E_2 \leqslant E' < E_1$ $E_1 \leqslant E' \leqslant E_i$	$W_e^{\rightarrow j} \equiv 0$ I II- Case 1; IV- Case 2 III $W_e^{\rightarrow i} \equiv 0$		$E_{i-1} \leqslant E' < E_4$ $E_4 \leqslant E' < E_3$ $E_3 \leqslant E' < E_2$ $E_2 \leqslant E' < E_i$	$W_e^{\rightarrow j} \equiv 0$ I II- Case 1 ; IV- Case 2 III		$E_{i-1} \leqslant E' < E_4$ $E_4 \leqslant E' < E_3$ $E_3 \leqslant E' \leqslant E_i$	$W_e^{\rightarrow j} \equiv 0$ I II- Case 1 ; IV- Case 2		$E_{i-1} \leqslant E' < E_4$ $E_4 \leqslant E' \leqslant E_i$	$W_e^{\rightarrow j} \equiv 0$ I		$E_{i-1} \leqslant E' \leqslant E_i$	$W_e^{\rightarrow j} \equiv 0$	
2	$E_{i-1} \leqslant E' < E_4$ $E_4 \leqslant E' < E_3$ $E_3 \leqslant E' < E_2$ $E_2 \leqslant E' \leqslant E_i$	I II- Case 1 ; IV- Case 2 III $W_e^{\rightarrow i} \equiv 0$		$E_{i-1} \leqslant E' < E_4$ $E_4 \leqslant E' < E_3$ $E_3 \leqslant E' < E_i$	I II- Case 1 ; IV- Case 2 III		$E_{i-1} \leqslant E' < E_4$ $E_4 \leqslant E' \leqslant E_i$	I II- Case 1 ; IV- Case 2		$E_{i-1} \leqslant E' \leqslant E_i$	I		transition impossible		
3	$E_{i-1} \leqslant E' < E_4$ $E_4 \leqslant E' < E_2$ $E_2 \leqslant E' \leqslant E_i$	II- Case 1 ; IV- Case 2 III $W_e^{\rightarrow i} \equiv 0$		$E_{i-1} \leqslant E' < E_4$ $E_4 \leqslant E' \leqslant E_i$	II- Case 1 ; IV- Case 2 III		$E_{i-1} \leqslant E' \leqslant E_i$	II- Case 1 ; IV- Case 2		transition impossible			transition impossible		
4	$E_{i-1} \leqslant E' < E_3$ $E_3 \leqslant E' \leqslant E_i$	III $W_e^{\rightarrow i} \equiv 0$		$E_{i-1} \leqslant E' \leqslant E_i$	III		transition impossible			transition impossible			transition impossible		
5	$E_{i-1} \leqslant E' \leqslant E_i$	$W_e^{\rightarrow i} \equiv 0$		Transition impossible			transition impossible			transition impossible			transition impossible		

Case 1 $E'_{max}(E_j) < E'_{min}(E_{j-1})$

$$\begin{cases} E_4 = E'_{max}(E_{j-1}) \\ E_3 = E'_{min}(E_{j-1}) \\ E_2 = E'_{max}(E_j) \\ E_1 = E'_{min}(E_j) \end{cases}$$

Case 2 $E'_{max}(E_j) > E'_{min}(E_{j-1})$

$$\begin{cases} E_4 = E'_{max}(E_{j-1}) \\ E_3 = E'_{max}(E_j) \\ E_2 = E'_{min}(E_j) \\ E_1 = E'_{min}(E_j) \end{cases}$$

Condition I $\begin{cases} \widetilde{E}_j = E'(1-\alpha_{in}) \\ \widetilde{E}_{j-1} = E_{j-1} \end{cases}$

Condition II $\begin{cases} \widetilde{E}_j = E'(1-\alpha_{in}) \\ \widetilde{E}_{j-1} = E'(1-\beta_{in}) \end{cases}$

Condition III $\begin{cases} \widetilde{E}_j = E_j \\ \widetilde{E}_{j-1} = E'(1-\beta_{in}) \end{cases}$

Condition IV $\begin{cases} \widetilde{E}_j = E_j \\ \widetilde{E}_{j-1} = E_{j-1} \end{cases}$

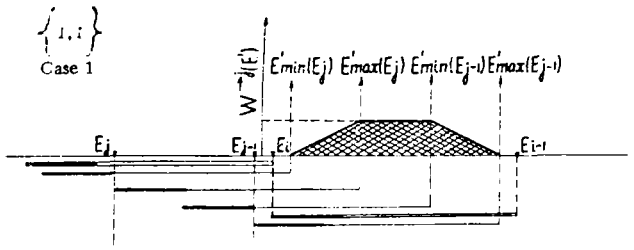


Fig. 18

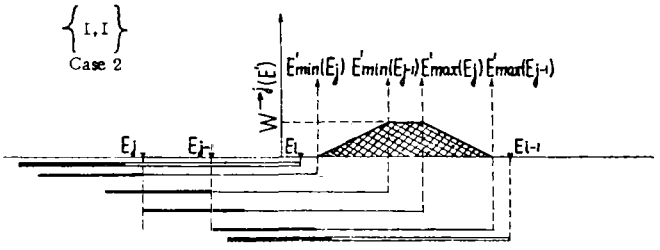


Fig. 19

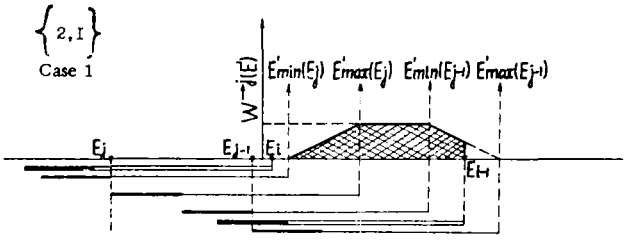


Fig. 20

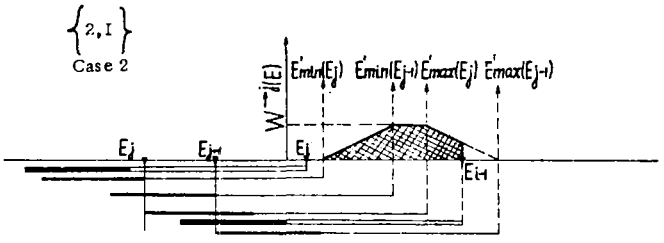


Fig. 21

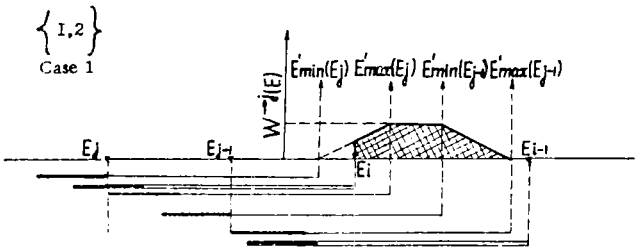


Fig. 22

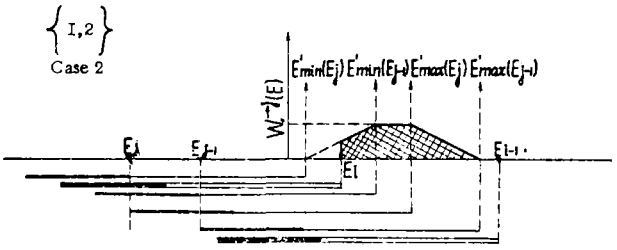


Fig. 23

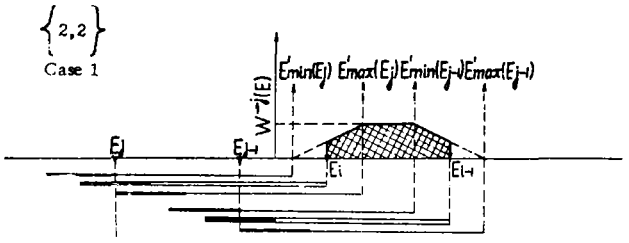


Fig. 24

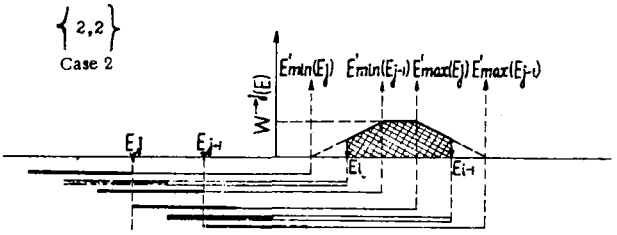


Fig. 25

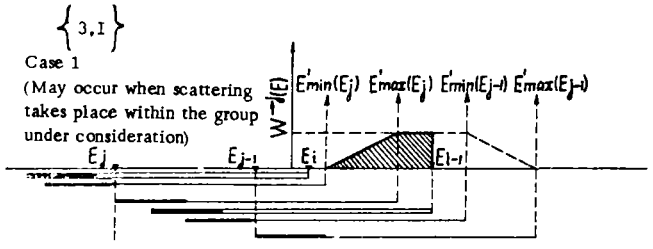


Fig. 26

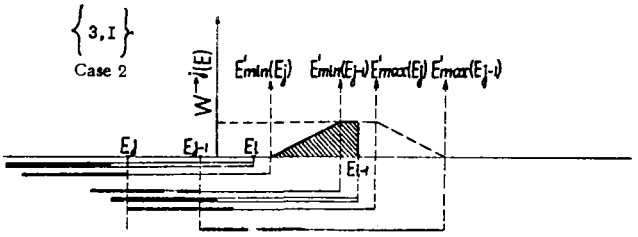


Fig. 27

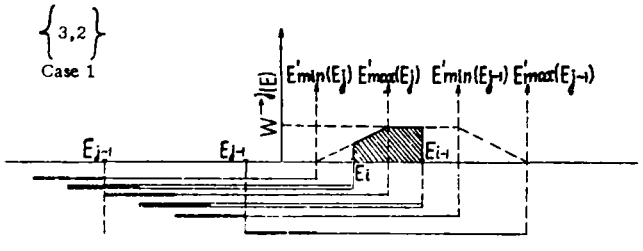


Fig. 28

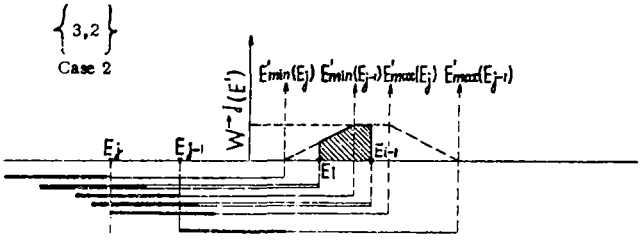


Fig. 29

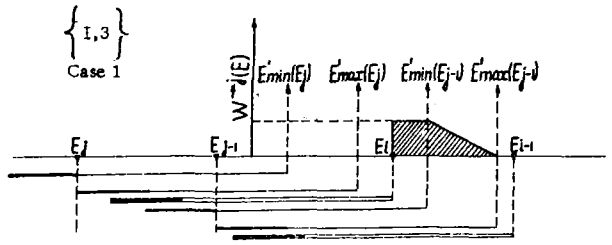


Fig. 30

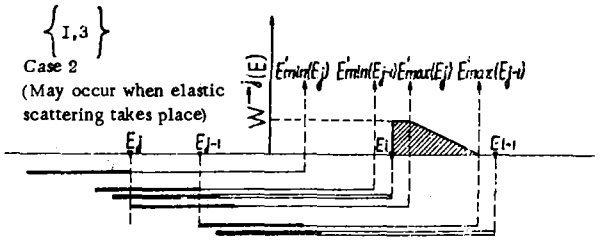


Fig. 31

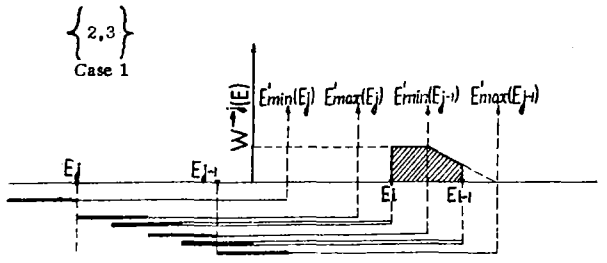


Fig. 32

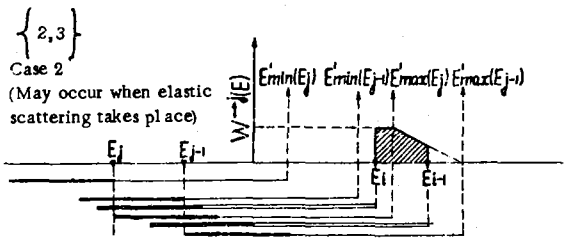


Fig. 33

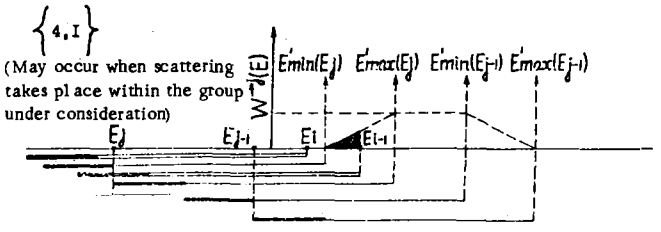


Fig. 34

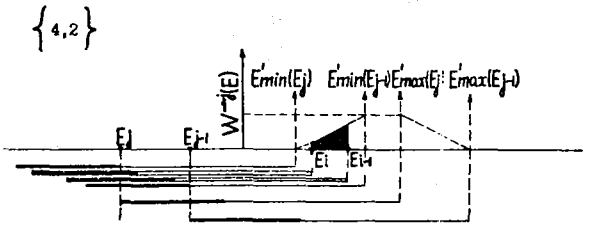


Fig. 35

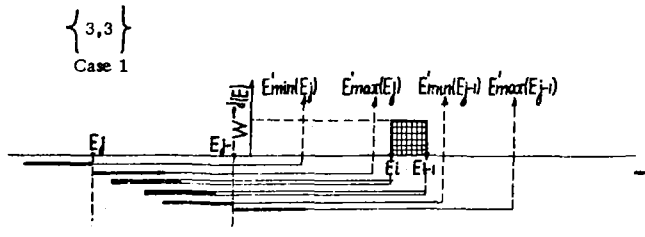


Fig. 36

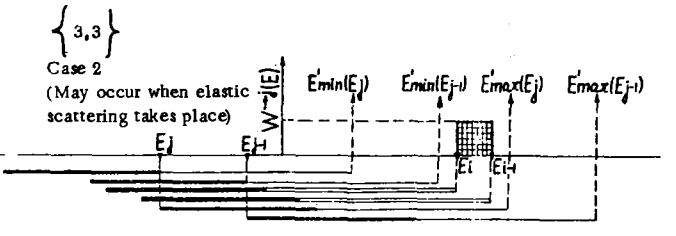


Fig. 37

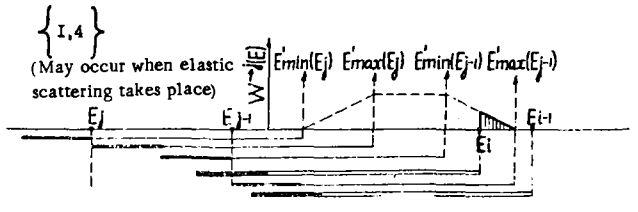


Fig. 38

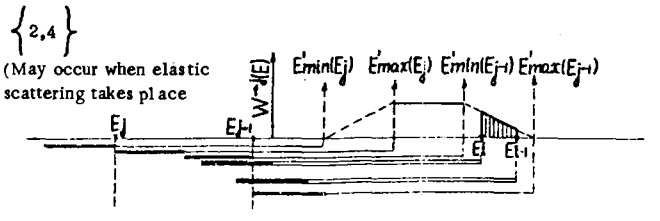


Fig. 39

TABLE 3

Serial No.	Variants		No. of interval in region	Energy region of group i from which inelastic scattering into group j is possible		Energy region of scattered neutrons arriving in group j	
				Lower energy of the interval in group i	Upper energy of the interval in group i	Smallest energy of the region	Largest energy of the region
I	{1.1}, {1.2}, {2.2}	Case 1	I	$\max[E_i, E'_{min}(E_j)]$	$E'_{max}(E_j)$	E_j	$E'(I-\beta_{in})$
			2	$E'_{max}(E_j)$	$E'_{min}(E_{j-1})$	$E'(I-\alpha_{in})$	$E'(I-\beta_{in})$
			3	$E'_{min}(E_{j-1})$	$\min[E_{i-1}, E'_{max}(E_{j-1})]$	$E'(I-\alpha_{in})$	E_{j-1}
2		Case 2	I	$\max[E_i, E'_{min}(E_j)]$	$E'_{min}(E_{j-1})$	E_j	$E'(I-\beta_{in})$
			2	$E'_{min}(E_{j-1})$	$E'_{max}(E_j)$	E_j	E_{j-1}
			3	$E'_{max}(E_j)$	$\min[E_{i-1}, E'_{max}(E_{j-1})]$	$E'(I-\alpha_{in})$	E_{j-1}
3	{3.1}, {3.2}	Case 1	I	$\max[E_i, E'_{min}(E_j)]$	$E'_{max}(E_j)$	E_j	$E'(I-\beta_{in})$
			2	$E'_{max}(E_j)$	E_{i-1}	$E'(I-\alpha_{in})$	$E'(I-\beta_{in})$
4		Case 2	I	$\max[E_i, E'_{min}(E_j)]$	$E'_{min}(E_{j-1})$	E_j	$E'(I-\beta_{in})$
			2	$E'_{min}(E_{j-1})$	E_{i-1}	E_j	E_{j-1}
5	{1.3}, {2.3}	Case 1	I	E_i	$E'_{min}(E_{j-1})$	$E'(I-\alpha_{in})$	$E'(I-\beta_{in})$
			2	$E'_{min}(E_{j-1})$	$\min[E_{i-1}, E'_{max}(E_{j-1})]$	$E'(I-\alpha_{in})$	E_{j-1}
6		Case 2	I	E_i	$E'_{max}(E_j)$	E_j	E_{j-1}
			2	$E'_{max}(E_j)$	$\min[E_{i-1}, E'_{max}(E_{j-1})]$	$E'(I-\alpha_{in})$	E_{j-1}
7	{3.3}	Case 1	I	E_i	E_{i-1}	$E'(I-\alpha_{in})$	$E'(I-\beta_{in})$
8		Case 2	I	E_i	E_{i-1}	E_j	E_{j-1}
9	{2.4}, {1.4}	Independent of ratio between $E'_{max}(E_j)$ & $E'_{min}(E_{j-1})$	I	E_i	$\min[E_{i-1}, E'_{max}(E_{j-1})]$	$E'(I-\alpha_{in})$	E_{j-1}
10	{4.2}, {4.1}		I	$\max[E_i, E'_{min}(E_j)]$	E_{i-1}	E_j	$E'(I-\beta_{in})$

Case 1 : $E'_{max}(E_j) < E'_{min}(E_{j-1})$;
Case 2 : $E'_{max}(E_j) > E'_{min}(E_{j-1})$.

TABLE 4

Serial No.	Variants		No. of interval in region	Energy region of group i from which elastic scattering into group j is possible		Energy region of scattered neutrons arriving in group j	
				Lower energy of the interval in group i	Upper energy of the interval in group i	Smallest energy of the region	Largest energy of the region
1	{3.I}	Case 1	1	$E_{min}(E_j)=E_j$	$E_{max}(E_j)=E_j/(I-\alpha)$	E_j	E'
			2	$E_{max}(E_j)=E_j/(I-\alpha)$	E_{j-1}	$E'(I-\alpha)$	E'
2	{4.I}	Case 1	1	$E_{min}(E_j)=E_j$	E_{j-1}	E_j	E'
3	{3.3}	Case 2	1	E_i	E_{i-1}	E_j	E_{j-1}
4	{I.3}	Case 2	1	E_i	$E_{max}(E_j)=E_j/(I-\alpha)$	E_j	E_{j-1}
			2	$E_{max}(E_j)=E_j/(I-\alpha)$	E_{i-1}	$E'(I-\alpha)$	E_{j-1}
5	{2.3}	Case 2	1	E_i	$E_{max}(E_j)=E_j/(I-\alpha)$	E_j	E_{j-1}
			2	$E_{max}(E_j)=E_j/(I-\alpha)$	$E_{max}(E_{j-1})=E_{j-1}/(I-\alpha)$	$E'(I-\alpha)$	E_{j-1}
6	{2.4}	Case 2	1	E_i	E_{i-1}	$E'(I-\alpha)$	E_{j-1}
7	{I.4}	Case 2	1	E_i	$E_{max}(E_{j-1})=E_{j-1}/(I-\alpha)$	$E'(I-\alpha)$	E_{j-1}

Case 1 : $E_{max}(E_j) < E_{min}(E_{j-1})$;
Case 2 : $E_{max}(E_j) > E_{min}(E_{j-1})$.

As a result we obtain:

$$\sum_{m=0}^{\infty} \omega_m^L (E') \cdot P_m (\mu_L) = \frac{d\mu_c}{d\mu_L} . \tag{86}$$

Thus, in the case of scattering which is spherically symmetrical in the centre-of-mass system, the coefficients of expansion for the angular distribution of scattered neutrons in the laboratory system of co-ordinates can be calculated analytically:

$$\omega_m^L = \frac{2m+1}{2} \int_{-1}^{+1} P_m (\mu_L) \cdot \frac{d\mu_c}{d\mu_L} \cdot d\mu_L , \tag{87}$$

It is a simple matter to determine $\frac{d\mu_C}{d\mu_L}$ from relation (58). The calculation of ω_m^L is a rather laborious task. For that reason it is convenient to replace the variables when calculating the integral in formulae (82) and (83), switching from the laboratory system of co-ordinates to the centre-of-mass system. $W_\ell^{\to j}(E')$ will then have the form

$$W_\ell^{\to j}(E') = \frac{1}{2} \int_{\mu_c(\tilde{E}_j, E')}^{\mu_c(\tilde{E}_{j-1}, E')} d\mu_c \tag{88}$$

and can be calculated analytically. If, namely, $E'_{min}(E_{j-1}) > E'_{max}(E_j)$, then

$$W^{\to j}(E') = \begin{cases} \frac{1}{2}\left[1 - \mu_c(E_j; E')\right] & \text{при } E'_{min}(E_j) \leqslant E' \leqslant E'_{max}(E_j); \\ 1 & \text{при } E'_{max}(E_j) \leqslant E' \leqslant E'_{min}(E_{j-1}); \\ \frac{1}{2}\left[\mu_c(E_{j-1}, E') + 1\right] & \text{при } E'_{min}(E_{j-1}) \leqslant E' \leqslant E'_{max}(E_{j-1}); \end{cases} \tag{89}$$

and if $E'_{min}(E_{j-1}) < E'_{max}(E_j)$, then

$$W^{\to j}(E') = \begin{cases} \frac{1}{2}\left[1 - \mu_c(E_j, E')\right] & \text{при } E'_{min}(E_j) \leqslant E' \leqslant E'_{min}(E_{j-1}); \\ \frac{1}{2}\left[\mu_c(E_{j-1}, E') - \mu_c(E_j, E)\right] & \text{при } E'_{min}(E_{j-1}) \leqslant E' \leqslant E'_{max}(E_j); \\ \frac{1}{2}\left[\mu_c(E_{j-1}, E') + 1\right] & \text{при } E'_{max}(E_j) \leqslant E' \leqslant E'_{max}(E_{j-1}). \end{cases} \tag{90}$$

The limits of the region of group i from which scattering into group j occurs are determined in this case as

$$\left.\begin{aligned} \tilde{E}_i &= \max\left[E_i,\ E'_{min}(E_j)\right]; \\ \tilde{E}_{i-1} &= \min\left[E_{i-1},\ E'_{max}(E_{j-1})\right]. \end{aligned}\right\} \qquad (91)$$

Following the calculation of $W^{i\to j}(E')$, the parameters for the anisotropy of inelastic scattering are calculated by means of formula (82).

The approximation which postulates isotropic inelastic scattering in the centre-of-mass system has been used, for example, to calculate parameters for the anisotropy of inelastic slowing down of neutrons in fluorine, chlorine and yttrium [12].

5. CALCULATION OF GROUP PARAMETERS FOR THE ANISOTROPY OF ELASTIC NEUTRON SCATTERING

In this section we shall consider certain details of the calculation of group parameters for the anisotropy of elastic scattering, as set out in the Annex.

These parameters are coefficients for expansion of the angular distribution of elastic scattering leading to a slowing down of neutrons from group i to group j and have been determined from expression (81). The initial data used were the coefficients $B_\ell(E)$ for expansion of the differential cross-section in Legendre polynomials (cf. Refs [5] and [6]):

$$\tilde{G}_e(E', \mu_L) = \frac{1}{4\pi}\sum_{m=0}^{\infty} B_m^L(E')\cdot P_m(\mu_L). \qquad (92)$$

Hence

$$B_m^L(E') = 2\pi(2m+1)\int_{-1}^{+1} G_e(E', \mu_L)\cdot P_m(\mu_L)\cdot d\mu_L \qquad (93)$$

and

$$B_0^L(E') = 2\pi\int_{-1}^{+1} G_0(E', \mu_L)\cdot d\mu_L = \tilde{G}_e(E'). \qquad (94)$$

Comparing the expansions in expressions (70) and (92), we see that

$$B_m^L(E') = \sigma_e(E') \cdot \omega_m^L(E') \,, \tag{95}$$

i.e. the quantity appearing in expression (81).

In the particular case of elastic scattering considered by us formula (81) assumes the form

$$W_{\ell(e)}^{i\to j} = \frac{\frac{2\ell+1}{2} \sum_{m=0}^{\infty} \int_{E_i}^{\min(E_{i-1},\, E_{j-1}/(1-\alpha))} \sigma_e(E') \cdot \omega_m^L(E') \cdot F_\ell(E') \cdot p_{\ell m}^{\to j}(E') \, dE'}{q_\ell \int_{E_i}^{E_{i-1}} \sigma_e(E') \cdot F_0(E') \cdot dE'} \tag{96}$$

where

$$p_{\ell m}^{\to j}(E') = \int_{\mu_L(\tilde{E}_j, E')}^{\mu_L(\tilde{E}_{j-1}, E')} P_\ell(\mu) \cdot P_m(\mu) \, d\mu \,. \tag{97}$$

Let us re-write expression (96) in a form more suitable for practical calculations:

$$W_{\ell(e)}^{i\to j} = \sum_{m=0}^{\infty} \frac{B_m^i}{B_0^i} \cdot A_{\ell m}^{i\to j} \cdot \beta_{\ell m}^{i\to j} \,, \tag{98}$$

where

$$B_m^i = \frac{\int_{E_i}^{E_{i-1}} \sigma_e(E') \cdot \omega_m^L(E') \cdot \varphi(E') \cdot dE'}{\int_{E_i}^{E_{i-1}} \varphi(E') \, dE'} \tag{99}$$

are the average group values of the mth harmonic of the elastic scattering cross-section;

$$A_{\ell m}^{i\to j} = \frac{2\ell+1}{2} \cdot \frac{\int_{E_i}^{\min(E_{i-1},\, E_{j-1}/(1-\alpha))} \varphi(E') \cdot p_{\ell m}^{\to j}(E') \, dE'}{\int_{E_i}^{E_{i-1}} \varphi(E') \, dE'} \tag{100}$$

In formulae (99) and (100) $\varphi(E')$ is the standard spectrum adopted a priori. As in Ref. [1], we have adopted as standard the spectrum of ^{235}U fission by thermal neutrons for $E' > 2.5$ MeV and the Fermi spectrum for lower energies:

$$\varphi(E') = \begin{cases} e^{-E'/0.965} \operatorname{sh}\sqrt{2.29 \cdot E'} & \text{при } E' > 2.5 \text{ Мэв} \\ 1/E' & \text{при } E' < 2.5 \text{ Мэв.} \end{cases} \quad (101)$$

The coefficients $b_{\ell m}^{i \to j}$ take into account errors associated with the replacement of the integrals in expression (96) by the products $(B_m^i/B_o^i) \times A_{\ell m}^{i \to j}$:

$$b_{\ell m}^{i \to j} = \frac{\int_{E_i}^{\min(E_{i-1}, E_{j-1}/(1-\alpha))} \sigma_e(E') \cdot \omega_m(E') \cdot F_\ell(E') \cdot p_{\ell m}^{\to j}(E') \cdot dE'}{q_\ell \int_{E_i}^{E_{i-1}} \sigma_e(E') \cdot \omega_m(E') \cdot \varphi(E') \cdot dE'} \times$$

$$\times \frac{\int_{E_i}^{E_{i-1}} \sigma_e(E') \cdot \varphi(E') \cdot dE'}{\int_{E_i}^{\min(E_{i-1}, E_{j-1}/(1-\alpha))} \varphi(E') \cdot p_{\ell m}^{\to j}(E') \cdot dE'} \times \frac{\int_{E_i}^{E_{i-1}} \varphi(E') \cdot dE'}{\int_{E_i}^{E_{i-1}} \sigma_e(E') \cdot F_o(E') \cdot dE'} . \quad (102)$$

In order to calculate the correction factors $b_{\ell m}^{i \to j}$ we use an approximation of the energy behaviour of $B_m(E') = \sigma_e(E') \times \omega_m(E')$ (which we assume to be averaged over the resonance characteristics) by step functions. This is done in a group approximation. In this case

$$b_{\ell m}^{i \to j} = \frac{\int_{E_i}^{\min(E_{i-1}, E_{j-1}/(1-\alpha))} F_\ell(E') \cdot p_{\ell m}(E') \cdot dE'}{q_\ell \int_{E_i}^{\min(E_{i-1}, E_{j-1}/(1-\alpha))} \varphi(E') \cdot p_{\ell m}(E') \cdot dE'} \times \frac{\int_{E_i}^{E_{i-1}} \varphi(E') dE'}{\int_{E_i}^{E_{i-1}} F_o(E') \cdot dE'} \quad (103)$$

represents the correction coefficient applied to $A_{\ell m}^{i \to j}$ for the difference between the true form of the intragroup spectrum and the standard form.

In accordance with what has been said in section 2, we assume as an approximation that the spectra of all harmonics of the neutron flux (averaged over the resonance structure) coincide within the group under consideration.

Thus, in expression (103) we can replace $F_\ell(E')$ by $F_0(E')$ calculated in a step cross-section approximation in the ARAMAKO programme [11].

Further, in view of the fact that we have had at our disposal only a relatively rough evaluation of the $F_\ell(E')$ form, it is natural to disregard in calculating the correction factors $b_{\ell m}^{i\to j}$ their dependence on ℓ and m due to scattering anisotropy, and to put

$$b_{\ell m}^{i\to j} = b^{i\to j} = \begin{cases} 1 & \text{при } j = i \\ \dfrac{F_0\left[E_i\left(1+\frac{2}{3}\xi\right)\right]}{\varphi\left[E_i\left(1+\frac{2}{3}\xi\right)\right]} \times \dfrac{\int_{E_i}^{E_{i-1}} \varphi(E')\,dE'}{\int_{E_i}^{E_{i-1}} F_0(E')\,dE'} & \end{cases}, \qquad (104)$$

since in the case of elastic scattering (in the centre-of-mass system) the average energy of neutrons slowing down from a particular group is given by $E(1 + \frac{2}{3}\xi)$. We may rely on this approximation giving acceptably accurate corrections to the form of the intragroup spectrum for slowing down on relatively heavy nuclei, when $\xi \ll \Delta u_i = \ln \frac{E_{i-1}}{E_i}$ and when the B factors can differ greatly from unity (if $F_0(E')$ differs greatly from the standard spectrum). In the case of light nuclei, when $\xi \sim \Delta u_i$ the values of the correction factors will differ little from unity even when there are large differences in $F_0(E')$ and $\varphi(E')$, since in this case neutrons can slow down from a large part of the group, and the ratio of the flux averaged over that part to the average flux for the whole group will be relatively weakly dependent on the shape of the spectrum. Hence, it is not important to take into account the difference (for different harmonics) in the effective parts of the group from which neutrons can disappear as a result of slowing down.

The $A_{\ell m}^{i\to j}$ coefficients were calculated as early as 1964 [15]. At that time we had just begun work on systematizing the initial data on the anisotropy of elastic scattering. The work was completed with the publication of an "Atlas" [5] containing recommended energy dependences for the $B_m^L(E')$ coefficients in the energy range from approximately 0.1 to 15 MeV for 42 isotopes. In constructing the recommended curves we used all available experimental data for each element, and also the results of some theoretical calculations.

The values of the group ratios B_m^i/B_o^i for 41 nuclei are set out in the Annex, which also contains, for purposes of comparison, the values of $\omega_1^i = 3\mu e$ (where μe has been taken from Ref. [1]) for most elements.

In order to obtain appropriate group transition cross-sections from the proposed parameters for the anisotropy of elastic scattering, it is necessary to multiply these parameters by the group cross-sections σ_e^i (cf. formula (80) in section 4) set out in Ref. [1].

Note also that with the exception of S all tables of anisotropy parameters comprise only 12 groups (S has 13 groups), the values of the moments of the last (12th or 13th) group corresponding to scattering which is isotropic in the centre-of-mass system. The implication is that in all groups lower than the 12th (or 13th in the case of S) the anisotropy parameters coincide with the parameters of this last group. In groups 9-12 there are normally no experimental data on angular distributions, and to obtain initial data for our calculations we interpolated between the last values known to us (from the Atlas [5]); $\omega_m^L(E') = B_m^L(E')/B_o(E)$ and ω_m^L corresponding to the isotropic energy region (in the centre-of-mass system of co-ordinates). For this reason, group-averaged (interpolation) values $\bar{\omega}_m^i$ were used in calculating the anisotropy parameters in groups 9-12 and not the B_m^i/B_o^i ratios.

For high energies and heavy elements six angular momenta are not sufficient to describe the angular distribution. Thus the angular distribution developed from the first 6 angular momenta shown in the tables can give a negative value of the differential cross-section at some angles. For certain calculations this factor has to be borne in mind (e.g. when analysing the angular albedo); but for the integral characteristics (K_{eff}, fast neutron dose) this inaccuracy in the description of the angular distributions is negligible.

In conclusion, the authors wish to thank A.F. Larinaya, who did a vast amount of work in calculating and checking the numerical data presented in this report, and also N.A. Nikolaeva for help in preparing the data print-out programmes.

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A N N E X

GROUP PARAMETERS FOR THE ANISOTROPY OF NEUTRON ELASTIC SCATTERING

Key to tables (pp 48-101)

= MeV

= $\frac{\text{B0 from group I to I + K}}{\text{B0}}$ (etc.)

= when K is equal to

Deuterium

B0 ИЗ I B I*K
B0

II	E МЭВ	ПРИ К РАВНОМ 0	1	2	3	4	5	B0I
1	6.50000	0.2397	0.4029	0.0983	0.1242	0.1288	0.0071	1.01
2	4.00000	0.2770	0.3280	0.1343	0.1522	0.1085	0.0000	1.01
3	2.50000	0.2736	0.3124	0.1531	0.2058	0.0501	0.0000	1.01
4	1.40000	0.2699	0.2573	0.2456	0.2055	0.0217	0.0000	1.01
5	0.80000	0.1780	0.3400	0.2359	0.1919	0.0340	0.0000	1.01
6	0.40000	0.1957	0.3732	0.2908	0.1400	0.0003	0.0000	1.01
7	0.20000	0.2357	0.4029	0.2837	0.0777	0.0000	0.0000	1.01
8	0.10000	0.2780	0.4469	0.2309	0.0442	0.0000	0.0000	1.01
9	0.04650	0.3206	0.4317	0.2070	0.0407	0.0000	0.0000	1.01
10	0.02150	0.3278	0.4292	0.2016	0.0424	0.0000	0.0000	1.01
11	0.01000	0.3356	0.4237	0.1959	0.0448	0.0000	0.0000	1.01
12	0.00465	0.3389	0.4227	0.1935	0.0449	0.0000	0.0000	1.01

B1 ИЗ I B I*K
B0

II	E МЭВ	ПРИ К РАВНОМ 0	1	2	3	4	5	B1 B0
1	6.50000	0.6516	0.8752	0.0741	-0.1015	-0.2312	-0.0205	1.1977
2	4.00000	0.7420	0.6848	0.0631	-0.1663	-0.2549	0.0000	1.0687
3	2.50000	0.7405	0.5929	0.0114	-0.3166	-0.1323	0.0000	0.8959
4	1.40000	0.6905	0.4116	-0.0496	-0.3924	-0.0599	0.0000	0.6002
5	0.80000	0.4460	0.4500	-0.1470	-0.4104	-0.0122	0.0000	0.3254
6	0.40000	0.4599	0.4275	-0.1912	-0.3000	-0.0008	0.0000	0.3954
7	0.20000	0.5587	0.4808	-0.1957	-0.1685	0.0000	0.0000	0.6753
8	0.10000	0.6635	0.5160	-0.1865	-0.0979	0.0000	0.0000	0.8931
9	0.04650	0.7402	0.4725	-0.1779	-0.0908	0.0000	0.0000	0.9530
10	0.02150	0.7680	0.4755	-0.1758	-0.0957	0.0000	0.0000	0.9720
11	0.01000	0.7985	0.4781	-0.1741	-0.1025	0.0000	0.0000	0.9900
12	0.00465	0.7971	0.4786	-0.1728	-1.0290	0.0000	0.0000	1.0000

B2 ИЗ I B I*K
B0

II	E МЭВ	ПРИ К РАВНОМ 0	1	2	3	4	5	B2 B0
1	6.50000	0.8963	0.6452	-0.1804	-0.2124	0.2126	0.0318	1.3931
2	4.00000	0.9803	0.4338	-0.2714	-0.1929	0.2440	0.0000	1.1958
3	2.50000	0.9611	0.2439	-0.3421	-0.0396	0.1682	0.0000	0.9915
4	1.40000	0.8242	-0.0057	-0.5081	0.1738	0.0836	0.0000	0.5678
5	0.80000	0.5062	-0.2187	-0.5418	0.2971	0.0187	0.0000	0.0615
6	0.40000	0.4453	-0.3490	-0.4867	0.2206	0.0014	0.0000	-0.1664
7	0.20000	0.5542	-0.3349	-0.4539	0.1266	0.0000	0.0000	-0.1000
8	0.10000	0.6709	-0.3853	-0.3409	0.0781	0.0000	0.0000	0.0228
9	0.04650	0.7212	-0.4011	-0.2842	0.0741	0.0000	0.0000	0.1100
10	0.02150	0.7443	-0.3852	-0.2704	0.0813	0.0000	0.0000	0.1700
11	0.01000	0.7702	-0.3667	-0.2544	0.0909	0.0000	0.0000	0.2400
12	0.00465	0.7805	-0.3636	-0.2493	0.0921	0.0000	0.0000	0.2597

I	E [illegible]	B3 ИЗ I B I+K / B0 при K равном 0	1	2	3	4	5	B3/B0
1	6.50000	[illegible]334	-0.0526	-0.2022	0.2550	-0.0004	-0.0399	0.8933
2	4.00000	0.9526	-0.1675	-0.1714	0.3585	-0.1365	0.0000	0.8657
3	2.50000	0.9039	-0.3215	-0.0333	0.3711	-0.1502	0.0000	0.7700
4	1.40000	0.6674	-0.4334	0.1242	0.1710	-0.0381	0.0000	0.4411
5	0.80000	0.3553	-0.6471	0.3518	-0.0001	-0.0231	0.0000	0.0463
6	0.40000	0.2161	-0.6617	0.3975	-0.0117	-0.0018	0.0000	-0.0616
7	0.20000	0.2920	-0.7020	0.3805	-0.0055	0.0000	0.0000	-0.0350
8	0.10000	0.3745	-0.7363	0.3521	-0.0080	0.0000	0.0000	-0.0177
9	0.04650	0.3572	-0.6692	0.3117	-0.0117	0.0000	0.0000	-0.0120
10	0.02150	0.3770	-0.6641	0.2990	-0.0194	0.0000	0.0000	-0.0075
11	0.01000	0.3996	-0.6571	0.2849	-0.0294	0.0000	0.0000	-0.0020
12	0.00465	0.4096	-0.6592	0.2806	-0.0310	0.0000	0.0000	0.0005

I	E [illegible]	B4 ИЗ I B I+K / B0 при K равном 0	1	2	3	4	5	B4/B0
1	6.50000	0.7952	-0.6430	0.0990	0.0571	-0.1674	0.0442	0.2061
2	4.00000	0.7247	-0.5939	0.2120	-0.0505	-0.0422	0.0000	0.2510
3	2.50000	0.6469	-0.5362	0.3515	-0.2568	0.0930	0.0000	0.2934
4	1.40000	0.3613	-0.3684	0.4326	-0.2727	0.0745	0.0000	0.2278
5	0.80000	0.1397	-0.2690	0.3772	-0.1966	0.0250	0.0000	0.0763
6	0.40000	-0.0243	-0.1040	0.2605	-0.1224	0.0022	0.0000	0.0120
7	0.20000	0.0054	-0.1558	0.2316	-0.0912	0.0000	0.0000	0.0000
8	0.10000	0.0377	-0.1273	0.1499	-0.0513	0.0000	0.0000	0.0000
9	0.04650	-0.0048	-0.0606	0.1055	-0.0416	0.0000	0.0000	-0.0015
10	0.02150	0.0065	-0.0757	0.0998	-0.0356	0.0000	0.0000	-0.0050
11	0.01000	0.0199	-0.0923	0.0930	-0.0280	0.0000	0.0000	-0.0075
12	0.00465	0.0280	-0.1016	0.0903	-0.0269	0.0000	0.0000	-0.0101

I	E [illegible]	B5 ИЗ I B I+K / B0 при K равном 0	1	2	3	4	5	B5/B0
1	6.50000	0.5626	-0.7402	0.2431	-0.2719	0.1687	-0.0443	-0.0816
2	4.00000	0.4227	-0.5613	0.2046	-0.2816	0.0985	0.0000	-0.1171
3	2.50000	0.3312	-0.3130	0.0459	-0.0919	-0.0256	0.0000	-0.0534
4	1.40000	0.0383	-0.0027	-0.1256	0.0998	-0.0486	0.0000	0.0117
5	0.80000	-0.0332	0.2560	-0.3347	0.1652	-0.0243	0.0000	0.0200
6	0.40000	-0.1154	0.3421	-0.3050	0.0956	-0.0025	0.0000	0.0148
7	0.20000	-0.1165	0.3221	-0.2743	0.0720	0.0000	0.0000	0.0033
8	0.10000	-0.1196	0.3238	-0.2610	0.0568	0.0000	0.0000	0.0030
9	0.04650	-0.1230	0.3002	-0.2196	0.0474	0.0000	0.0000	0.0030
10	0.02150	-0.1254	0.2881	-0.2073	0.0446	0.0000	0.0000	0.0030
11	0.01000	-0.1215	0.2739	-0.1933	0.0409	0.0000	0.0000	0.0030
12	0.00465	-0.1134	0.2670	-0.1895	0.0409	0.0000	0.0000	0.0000

Tritium

	B0 из I в I+K					B1 из I в I+K				
	B0					B0				
II	E МэВ	при K равном				B0	при K равном				B1
		0	1	2	3		0	1	2	3	B0
1	6.50000	0.3661	0.4095	0.1007	0.1237	1.0	0.9706	0.8138	-0.0915	-0.2896	1.4033
2	4.00000	0.3854	0.3045	0.2134	0.0967	1.0	0.9915	0.5300	-0.2597	-0.2487	1.0211
3	2.50000	0.3486	0.2948	0.2971	0.0595	1.0	0.3817	0.3545	-0.4967	-0.1574	0.5821
4	1.40000	0.2572	0.3202	0.4119	0.0107	1.0	0.6026	0.1488	-0.7078	-0.0299	0.0137
5	0.80000	0.1711	0.5070	0.3219	0.0000	1.0	0.3749	0.0720	-0.6274	0.0000	-0.1805
6	0.40000	0.2732	0.5111	0.2157	0.0000	1.0	0.5548	0.0065	-0.4250	0.0000	0.1363
7	0.20000	0.3265	0.4972	0.1763	0.0000	1.0	0.6749	0.0918	-0.3391	0.0000	0.4276
8	0.10000	0.3491	0.5233	0.1276	0.0000	1.0	0.7260	0.0819	-0.2577	0.0000	0.5502
9	0.04650	0.3885	0.5018	0.1097	0.0000	1.0	0.7776	0.0432	-0.2208	0.0000	0.6000
10	0.02150	0.3925	0.4999	0.1076	0.0000	1.0	0.7869	0.0493	-0.2162	0.0000	0.6200
11	0.01000	0.3973	0.4980	0.1047	0.0000	1.0	0.7978	0.0571	-0.2099	0.0000	0.6450
12	0.00465	0.4017	0.4962	0.1021	0.0000	1.0	0.8086	0.0624	-0.2044	0.0000	0.6666

	B2 из I в I+K					B3 из I в I+K				
	B0					B0				
II	E МэВ	при K равном				B2	при K равном				B3
		0	1	2	3	B0	0	1	2	3	B0
1	6.50000	1.2588	0.4492	-0.1239	0.2770	1.8611	1.1980	-0.2293	0.1448	-0.1204	0.9851
2	4.00000	1.2052	0.1552	-0.1402	0.2678	1.4880	1.0270	-0.2848	0.3059	-0.1816	0.8665
3	2.50000	1.0311	-0.1166	0.0929	0.2013	1.2087	0.8173	-0.2566	0.3081	-0.1820	0.6868
4	1.40000	0.5939	-0.4616	0.2093	0.0432	0.3848	0.3414	-0.1763	0.2825	-0.0484	0.3992
5	0.80000	0.3064	-0.7500	0.3437	0.0000	-0.0999	0.0954	-0.0207	0.0977	0.0000	0.1724
6	0.40000	0.3713	-0.6276	0.2504	0.0000	-0.0059	0.0485	0.0114	0.0235	0.0000	0.0834
7	0.20000	0.4764	-0.6070	0.1807	0.0000	0.0501	0.0868	-0.1020	0.0437	0.0000	0.0285
8	0.10000	0.5208	-0.5996	0.1604	0.0000	0.0316	0.1016	-0.1164	0.0148	0.0000	0.0000
9	0.04650	0.5060	-0.5460	0.1360	0.0000	0.0960	0.0417	-0.0779	0.0162	0.0000	0.0000
10	0.02150	0.5147	-0.5438	0.1321	0.0000	0.1030	0.0658	-0.0835	0.0177	0.0000	0.0000
11	0.01000	0.5248	-0.5424	0.1266	0.0000	0.1090	0.0703	-0.0903	0.0200	0.0000	0.0000
12	0.00465	0.5356	-0.5447	0.1221	0.0000	0.1130	0.0778	-0.0995	0.0217	0.0000	0.0000

	B4 из I в I+K					B5 из I в I+K				
	B0					B0				
II	E МэВ	при K равном				B4	при K равном				B5
		0	1	2	3	B0	0	1	2	3	B0
1	6.50000	0.9026	-0.5879	0.0312	-0.0240	0.3219	0.5448	-0.4882	-0.0850	0.0770	0.0486
2	4.00000	0.6464	-0.3736	-0.0695	0.0490	0.2523	0.2884	-0.2258	-0.1125	0.0499	0.0000
3	2.50000	0.4479	-0.1095	-0.2556	0.1165	0.1993	0.1455	-0.1022	-0.0054	-0.0379	0.0000
4	1.40000	0.0968	0.2111	-0.2341	0.0449	0.1187	0.0018	0.0377	-0.0049	-0.0346	0.0000
5	0.80000	-0.0370	0.3175	-0.2200	0.0000	0.0605	-0.0183	-0.0450	0.0633	0.0000	0.0000
6	0.40000	-0.0564	0.1817	-0.0931	0.0000	0.0322	0.0232	-0.0214	-0.0018	0.0000	0.0000
7	0.20000	-0.0725	0.1719	-0.0801	0.0000	0.0193	-0.0009	0.0156	-0.0147	0.0000	0.0000
8	0.10000	-0.0818	0.1649	-0.0763	0.0000	0.0068	-0.0131	-0.0009	0.0140	0.0000	0.0000
9	0.04650	-0.0758	0.1496	-0.0688	0.0000	0.0050	0.0094	-0.0230	0.0136	0.0000	0.0000
10	0.02150	-0.0762	0.1469	-0.0687	0.0000	0.0020	0.0077	-0.0213	0.0136	0.0000	0.0000
11	0.01000	-0.0767	0.1449	-0.0686	0.0000	-0.0004	0.0061	-0.0194	0.0133	0.0000	0.0000
12	0.00465	-0.0734	0.1406	-0.0691	0.0000	-0.0019	0.0092	-0.0224	0.0132	0.0000	0.0000

Helium-3

	E МэВ	B0 из I в I+K при K равном 0	1	2	3	B0	B1 из I в I+K при K равном 0	1	2	3	B1 B0
1	6.50000	0.4214	0.4212	0.0768	0.0806	1.0	1.1192	0.8455	-0.0607	-0.1907	1.71
2	4.00000	0.4746	0.3219	0.1433	0.0602	1.0	1.2346	0.6268	-0.1845	-0.1486	1.52
3	2.50000	0.4588	0.3102	0.1968	0.0342	1.0	1.1766	0.4656	-0.3052	-0.0898	1.24
4	1.40000	0.3846	0.3105	0.2954	0.0095	1.0	0.9306	0.2393	-0.4941	-0.0268	0.64
5	0.80000	0.2686	0.4743	0.2571	0.0000	1.0	0.6122	0.1575	-0.5057	0.0000	0.26
6	0.40000	0.3056	0.4933	0.2011	0.0000	1.0	0.6352	0.0772	-0.3929	0.0000	0.31
7	0.20000	0.3288	0.4958	0.1754	0.0000	1.0	0.6885	0.1433	-0.3317	0.0000	0.50
8	0.10000	0.3536	0.5245	0.1219	0.0000	1.0	0.7424	0.1174	-0.2425	0.0000	0.61
9	0.04650	0.3981	0.4993	0.1026	0.0000	1.0	0.7989	0.0609	-0.2048	0.0000	0.65
10	0.02150	0.4096	0.4978	0.1016	0.0000	1.0	0.8049	0.0644	-0.2027	0.0000	0.66
11	0.01000	0.4010	0.4970	0.1020	0.0000	1.0	0.8061	0.0642	-0.2037	0.0000	0.66
12	0.00465	0.4017	0.4962	0.1021	0.0000	1.0	0.8087	0.0625	-0.2044	0.0000	0.66

	E МэВ	B2 из I в I+K при K равном 0	1	2	3	B2 B0	B3 из I в I+K при K равном 0	1	2	3	B3 B0
1	6.50000	1.4579	0.5052	-0.1164	0.1894	2.0352	1.3952	-0.1546	0.1170	-0.1042	1.253
2	4.00000	1.5374	0.3294	-0.0799	0.1615	1.9484	1.3646	-0.1999	0.2182	-0.1029	1.294
3	2.50000	1.4185	0.0524	-0.0031	0.1130	1.5808	1.1870	-0.2424	0.2630	-0.0989	1.108
4	1.40000	0.9899	-0.3233	0.1202	0.0389	0.8257	0.6669	-0.2440	0.2149	-0.0439	0.593
5	0.80000	0.5600	-0.6407	0.2934	0.0000	0.2127	0.2620	-0.1458	0.0414	0.0000	0.157
6	0.40000	0.4575	-0.5931	0.2251	0.0000	0.0395	0.0984	-0.0833	0.0264	0.0000	0.041
7	0.20000	0.5056	-0.5910	0.1635	0.0000	0.0781	0.1166	-0.1646	0.0608	0.0000	0.012
8	0.10000	0.5491	-0.5984	0.1417	0.0000	0.0924	0.1287	-0.1510	0.0294	0.0000	0.007
9	0.04650	0.5235	-0.5500	0.1205	0.0000	0.0940	0.0675	-0.0918	0.0243	0.0000	0.000
10	0.02150	0.5297	-0.5469	0.1192	0.0000	0.1020	0.0711	-0.0953	0.0242	0.0000	0.000
11	0.01000	0.5320	-0.5435	0.1205	0.0000	0.1090	0.0728	-0.0959	0.0231	0.0000	0.000
12	0.00465	0.5356	-0.5447	0.1221	0.0000	0.1130	0.0774	-0.0990	0.0216	0.0000	0.000

	E МэВ	B4 из I в I+K при K равном 0	1	2	3	B4 B0
1	6.50000	1.0609	-0.5543	0.0586	0.0175	0.5827
2	4.00000	0.9171	-0.4726	-0.0745	0.0179	0.3879
3	2.50000	0.7167	-0.2649	-0.1705	0.0583	0.3396
4	1.40000	0.2769	0.0534	-0.1466	0.0414	0.2251
5	0.80000	0.0188	0.2223	-0.1331	0.0000	0.1080
6	0.40000	-0.0534	0.1628	-0.0789	0.0000	0.0305
7	0.20000	-0.0622	0.1557	-0.0842	0.0000	0.0093
8	0.10000	-0.0711	0.1553	-0.0820	0.0000	0.0022
9	0.04650	-0.0783	0.1503	-0.0702	0.0000	0.0018
10	0.02150	-0.0775	0.1475	-0.0695	0.0000	0.0005
11	0.01000	-0.0771	0.1450	-0.0689	0.0000	-0.0010
12	0.00465	-0.0734	0.1406	-0.0691	0.0000	-0.0019

Helium-4

		B0 из I в I+K					B1 из I в I+K				
		B0					B0				
		при K равном				B0	при K равном				B1
I	E МэВ	0	1	2	3	B0	0	1	2	3	B0
1	6.50000	0.4013	0.4706	0.1231	0.0050	1.0	1.0125	0.7261	-0.2309	-0.0143	1.4934
2	4.00000	0.4810	0.4041	0.1149	0.0000	1.0	1.1728	0.5437	-0.2032	0.0000	1.5133
3	2.50000	0.4763	0.4368	0.0869	0.0000	1.0	1.1393	0.3689	-0.1757	0.0000	1.3325
4	1.40000	0.5054	0.3853	0.1093	0.0000	1.0	1.1365	0.2311	-0.2297	0.0000	1.1379
5	0.80000	0.4366	0.4677	0.0957	0.0000	1.0	0.9752	-0.3015	-0.2293	0.0000	0.4444
6	0.40000	0.2796	0.6497	0.0707	0.0000	1.0	0.5953	-0.8506	-0.1684	0.0000	-0.6037
7	0.20000	0.2044	0.7203	0.0753	0.0000	1.0	0.1946	-0.6319	-0.1742	0.0000	-0.6115
8	0.10000	0.3142	0.6496	0.0362	0.0000	1.0	0.4533	-0.4144	-0.0888	0.0000	-0.0499
9	0.04650	0.4215	0.5515	0.0270	0.0000	1.0	0.6387	-0.3023	-0.0664	0.0000	0.2700
10	0.02150	0.4499	0.5245	0.0256	0.0000	1.0	0.7230	-0.2550	-0.0630	0.0000	0.4050
11	0.01000	0.4628	0.5121	0.0251	0.0000	1.0	0.7614	-0.2346	-0.0618	0.0000	0.4650
12	0.00465	0.4707	0.5042	0.0251	0.0000	1.0	0.7883	-0.2261	-0.0622	0.0000	0.5000

		B2 из I в I+K					B3 из I в I+K				
		B0					B0				
		при K равном				B2	при K равном				B3
I	E МэВ	0	1	2	3	B0	0	1	2	3	B0
1	6.50000	1.1865	0.0970	0.1164	0.0218	1.4217	0.9643	-0.4450	0.0271	-0.0266	0.5198
2	4.00000	1.2758	-0.0522	0.0760	0.0000	1.2996	0.9109	-0.4043	0.0516	0.0000	0.5582
3	2.50000	1.1847	-0.2536	0.1079	0.0000	1.0390	0.7737	-0.2996	0.0183	0.0000	0.4924
4	1.40000	1.0422	-0.2271	0.1659	0.0000	0.9810	0.5671	-0.1964	-0.0231	0.0000	0.3476
5	0.80000	0.8775	-0.2460	0.2342	0.0000	0.8657	0.4562	0.1659	-0.1343	0.0000	0.4878
6	0.40000	0.8457	-0.0796	0.1692	0.0000	0.1353	-0.0202	0.3916	-0.0928	0.0000	0.2786
7	0.20000	-0.2250	-0.4384	0.1608	0.0000	-0.5026	-0.2791	0.4083	-0.0644	0.0000	0.0648
8	0.10000	0.0076	-0.4635	0.0954	0.0000	-0.3605	-0.2029	0.2662	-0.0588	0.0000	0.0045
9	0.04650	0.1286	-0.3900	0.0714	0.0000	-0.1900	-0.1270	0.1717	-0.0447	0.0000	0.0000
10	0.02150	0.2301	-0.3536	0.0685	0.0000	-0.0550	-0.0733	0.1176	-0.0443	0.0000	0.0000
11	0.01000	0.2773	-0.3350	0.0677	0.0000	0.0100	-0.0479	0.0924	-0.0445	0.0000	0.0000
12	0.00465	0.3140	-0.3195	0.0686	0.0000	0.0630	-0.0241	0.0697	-0.0456	0.0000	0.0000

		B4 из I в I+K				
		B0				
		при K равном				B4
I	E МэВ	0	1	2	3	B0
1	6.50000	0.5825	-0.4665	-0.0441	0.0280	0.0999
2	4.00000	0.4442	-0.3108	-0.0334	0.0000	0.1000
3	2.50000	0.3147	-0.1518	-0.0681	0.0000	0.0948
4	1.40000	0.2007	-0.1015	-0.0489	0.0000	0.0503
5	0.80000	0.1473	-0.0267	0.0177	0.0000	0.1383
6	0.40000	0.1625	-0.0941	0.0073	0.0000	0.0757
7	0.20000	0.0138	0.0163	-0.0301	0.0000	0.0000
8	0.10000	-0.0145	0.0075	0.0070	0.0000	0.0000
9	0.04650	-0.0023	-0.0031	0.0054	0.0000	0.0000
10	0.02150	-0.0007	-0.0071	0.0078	0.0000	0.0000
11	0.01000	0.0002	-0.0094	0.0092	0.0000	0.0000
12	0.00465	0.0074	-0.0182	0.0108	0.0000	0.0000

		B0 из I в I←K				B1 из I в I←K				B2 из I в I←K			
		B0				B0				B0			
II	E из	при K равном			B0I	при K равном			B1	при K равном			B2
I	I	0	1	2	B0I	0	1	2	B0	0	1	2	B0
1	6.50000	0.6305	0.3397	0.0298	1.0	1.6263	0.3805	-0.0748	1.9320	2.0160	0.1765	0.0859	2.2784
2	4.00000	0.5543	0.3845	0.0612	1.0	1.3339	0.1172	-0.1478	1.3033	1.4515	-0.0931	0.1538	1.5122
3	2.50000	0.4698	0.5185	0.0117	1.0	0.9781	-0.2576	-0.0317	0.6888	0.7799	-0.1293	0.0433	0.6939
4	1.40000	0.5591	0.4337	0.0072	1.0	0.8672	-0.2145	-0.0191	0.6336	0.3280	-0.1927	0.0243	0.1596
5	0.80000	0.5467	0.4533	0.0000	1.0	0.8985	-0.1838	0.0000	0.7147	0.3860	-0.2111	0.0000	0.1749
6	0.40000	0.5908	0.4092	0.0000	1.0	0.8874	-0.2191	0.0000	0.6683	0.4309	-0.0848	0.0000	0.3461
7	0.20000	0.5021	0.4979	0.0000	1.0	0.8106	-0.5146	0.0000	0.2960	0.4654	0.0070	0.0000	0.4724
8	0.10000	0.6145	0.3855	0.0000	1.0	0.3639	-0.4679	0.0000	-0.1040	-0.1084	0.0938	0.0000	-0.0146
9	0.04650	0.5512	0.4488	0.0000	1.0	0.3992	-0.4592	0.0000	-0.0600	-0.0309	0.0009	0.0000	-0.0300
10	0.02150	0.5753	0.4247	0.0000	1.0	0.4984	-0.3934	0.0000	0.1050	0.0379	-0.0279	0.0000	0.0100
11	0.01000	0.5921	0.4079	0.0000	1.0	0.5645	-0.3445	0.0000	0.2200	0.0759	-0.0559	0.0000	0.0200
12	0.00465	0.6094	0.3906	0.0000	1.0	0.6318	-0.2985	0.0000	0.3333	0.1132	-0.0853	0.0000	0.0279

		B3 из I в I←K				B4 из I в I←K				B5 из I в I←K			
		B0				B0				B0			
II	E из	при K равном			B3	при K равном			B4	при K равном			B5
I	I	0	1	2	B0	0	1	2	B0	0	1	2	B0
1	6.50000	1.8260	-0.0173	-0.0643	1.7444	1.3085	-0.2000	0.0289	1.1374	0.7354	-0.2962	-0.0008	0.4384
2	4.00000	1.0980	-0.0731	-0.0925	0.9324	0.6152	-0.1403	0.0185	0.4934	0.2235	-0.1956	0.0193	0.0472
3	2.50000	0.3728	-0.0540	-0.0439	0.2749	0.1353	-0.0852	0.0347	0.0848	0.0251	-0.0042	-0.0198	0.0011
4	1.40000	0.0489	-0.0086	-0.0218	0.0185	0.0196	-0.0319	0.0133	0.0010	-0.0192	0.0226	-0.0032	0.0002
5	0.80000	0.0580	-0.0186	0.0000	0.0394	0.0406	-0.0330	0.0000	0.0076	0.0039	-0.0036	0.0000	0.0000
6	0.40000	0.1725	-0.0408	0.0000	0.1317	0.0672	-0.0346	0.0000	0.0326	0.0210	-0.0210	0.0000	0.0000
7	0.20000	0.2095	0.0073	0.0000	0.2168	0.0732	0.0126	0.0000	0.0858	0.0106	-0.0108	0.0000	0.0000
8	0.10000	0.0771	-0.0174	0.0000	0.0597	0.0185	0.0142	0.0000	0.0327	0.0095	-0.0096	0.0000	0.0000
9	0.04650	0.0023	0.0157	0.0000	0.0180	0.0045	-0.0045	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.02150	0.0082	0.0018	0.0000	0.0100	0.0025	-0.0025	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11	0.01000	0.0080	-0.0030	0.0000	0.0050	0.0013	-0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.00465	0.0062	-0.0062	0.0000	0.0000	-0.0005	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

		B0 ИЗ I В I*K				B1 ИЗ I В I*K				B2 ИЗ I В I*K			
		B0				B0				B0			
II	E МЭВ	ПРИ К РАВНОМ			B0	ПРИ К РАВНОМ			B1	ПРИ К РАВНОМ			B2
I		0	1	2	B0	0	1	2	B0	0	1	2	60
1	6.50000	0.5976	0.3858	0.0166	1.0	1.5156	0.1547	-0.0454	1.6249	1.8564	0.0628	0.0628	1.9820
2	4.00000	0.5094	0.4610	0.0296	1.0	1.1512	-0.1869	-0.0784	0.8859	1.1860	-0.0450	0.1004	1.2414
3	2.50000	0.5016	0.4984	0.0000	1.0	0.9513	-0.4070	0.0000	0.5443	0.6871	0.0899	0.0000	0.7770
4	1.40000	0.5678	0.4319	0.0003	1.0	0.7586	-0.3667	-0.0009	0.3910	0.3076	-0.0106	0.0015	0.2985
5	0.80000	0.5354	0.4646	0.0000	1.0	0.6299	-0.4344	0.0000	0.1955	0.0750	-0.0527	0.0000	0.0223
6	0.40000	0.4933	0.5067	0.0000	1.0	0.2430	-0.5859	0.0000	-0.3429	-0.1367	0.0253	0.0000	-0.1114
7	0.20000	0.5740	0.4260	0.0000	1.0	0.6981	-0.4495	0.0000	0.2486	0.3508	-0.0013	0.0000	0.3495
8	0.10000	0.7133	0.2867	0.0000	1.0	0.9911	-0.1528	0.0000	0.8383	0.3735	-0.1305	0.0000	0.2430
9	0.04650	0.6578	0.3422	0.0000	1.0	0.5372	-0.2672	0.0000	0.2700	0.0400	-0.0840	0.0000	-0.0440
10	0.02150	0.6503	0.3497	0.0000	1.0	0.5047	-0.2947	0.0000	0.2100	0.0463	-0.0563	0.0000	-0.0100
11	0.01000	0.6534	0.3466	0.0000	1.0	0.5226	-0.2876	0.0000	0.2350	0.0619	-0.0569	0.0000	0.0050
12	0.00465	0.6601	0.3399	0.0000	1.0	0.5575	-0.2718	0.0000	0.2857	0.0842	-0.0637	0.0000	0.0205

		B3 ИЗ I В I*K				B4 ИЗ I В I*K				B5 ИЗ I В I*K			
		B0				B0				B0			
II	E МЭВ	ПРИ К РАВНОМ			B3	ПРИ К РАВНОМ			B4	ПРИ К РАВНОМ			B5
I		0	1	2	B0	0	1	2	B0	0	1	2	B0
1	6.50000	1.6788	0.1459	-0.0656	1.7591	1.1554	-0.0282	0.0558	1.1830	0.0000	0.0000	0.0000	0.0000
2	4.00000	0.9226	0.0483	-0.0913	0.8796	0.5334	-0.1404	0.0594	0.4524	0.0000	0.0000	0.0000	0.0000
3	2.50000	0.3811	-0.1351	0.0000	0.2460	0.1743	-0.0313	0.0000	0.1430	0.0000	0.0000	0.0000	0.0000
4	1.40000	0.1311	-0.0738	-0.0020	0.0553	0.0435	0.0322	0.0023	0.0780	0.0000	0.0000	0.0000	0.0000
5	0.80000	-0.0110	0.0110	0.0000	0.0000	-0.0072	0.0134	0.0000	0.0062	0.0000	0.0000	0.0000	0.0000
6	0.40000	-0.0485	0.0527	0.0000	0.0042	-0.0031	0.0056	0.0000	0.0025	0.0000	0.0000	0.0000	0.0000
7	0.20000	0.1369	0.0282	0.0000	0.1651	0.0209	0.0438	0.0000	0.0647	0.0000	0.0000	0.0000	0.0000
8	0.10000	0.0858	-0.0090	0.0000	0.0768	0.0509	0.0090	0.0000	0.0599	0.0000	0.0000	0.0000	0.0000
9	0.04650	-0.0100	0.0100	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.02150	-0.0022	0.0022	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11	0.01000	0.0011	-0.0011	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.00465	0.0038	-0.0038	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Beryllium

			B0 из I в I+K			B1 из I в I+K			B2 из I в I+K		
			B0			B0			B0		
II	E МЭВ	при к равном		B0	при к равном		B1	при к равном		B2
		0	1	B0	0	1	B0		1	B0
1	6.50000	0.6730	0.3270	1.0	1.6490	0.1367	1.7857	1.9706	0.0958	2.0564
2	4.00000	0.7207	0.2793	1.0	1.6004	-0.0209	1.5795	1.6455	0.0941	1.7396
3	2.50000	0.6590	0.3410	1.0	1.4642	-0.2781	1.1861	1.5613	0.1469	1.7079
4	1.40000	0.7000	0.3000	1.0	0.7557	-0.1606	0.5951	0.6141	-0.0130	0.6011
5	0.80000	0.6400	0.3600	1.0	0.8522	-0.2186	0.6336	0.3519	-0.0990	0.2529
6	0.40000	0.7087	0.2913	1.0	0.4385	-0.2390	0.1995	0.1661	-0.0508	0.1153
7	0.20000	0.6902	0.3098	1.0	0.5113	-0.2438	0.2675	0.0682	-0.0644	0.0038
8	0.10000	0.6933	0.3067	1.0	0.5044	-0.2481	0.2563	0.0666	-0.0566	0.0100
9	0.04650	0.7307	0.2693	1.0	0.4581	-0.2241	0.2340	0.0527	-0.0427	0.0100
10	0.02150	0.7301	0.2699	1.0	0.4538	-0.2258	0.2280	0.0516	-0.0416	0.0100
11	0.01000	0.7298	0.2702	1.0	0.4517	-0.2267	0.2250	0.0510	-0.0410	0.0100
12	0.00465	0.7302	0.2698	1.0	0.4505	-0.2283	0.2222	0.0519	-0.0396	0.0123

			B3 из I в I+K			B4 из I в I+K			B5 из I в I+K		
			B0			B0			B0		
II	E МЭВ	при к равном		B3	при к равном		B4	при к равном		B5
		0	1	B0	0	1	B0	0	1	B0
1	6.50000	1.7723	0.0112	1.7835	1.2490	-0.1581	1.0909	0.6596	-0.1388	0.5206
2	4.00000	1.1941	0.0171	1.2112	0.6068	-0.1322	0.4246	0.2080	-0.1056	0.1024
3	2.50000	1.1900	0.0120	1.2020	0.5972	-0.1782	0.4190	0.1664	-0.0616	0.1048
4	1.40000	0.2829	-0.1013	0.1816	0.1215	-0.0169	0.1046	0.0206	-0.0105	0.0101
5	0.80000	0.0909	-0.0098	0.0811	0.0224	-0.0224	0.0000	0.0151	-0.0151	0.0000
6	0.40000	-0.0023	-0.0010	-0.0033	-0.0009	0.0009	0.0000	0.0033	-0.0033	0.0000
7	0.20000	0.0013	-0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
8	0.10000	0.0018	-0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
9	0.04650	0.0018	-0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.02150	0.0018	-0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11	0.01000	0.0018	-0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.00465	0.0018	-0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Boron

			B0 ИЗ I в I+K			B1 ИЗ I в I+K			B2 ИЗ I в I+K		
			B0			B0			B0		
I	II	E МЭВ	ПРИ К РАВНОМ		B0	ПРИ К РАВНОМ		B1	ПРИ К РАВНОМ		B2
I	I		0	1	B0	0	1	B0	0	1	B0
I 1		6.50000	0.5721	0.4279	1.0	1.2549	-0.3513	0.9036	1.5256	0.2996	1.8252
I 2		4.00000	0.6160	0.3840	1.0	1.0914	-0.3240	0.7674	1.2260	0.2308	1.4568
I 3		2.50000	0.6618	0.3382	1.0	1.0395	-0.2318	0.8077	0.9632	0.1097	1.0729
I 4		1.40000	0.6894	0.3106	1.0	0.6673	-0.2766	0.3907	0.4364	0.0114	0.4478
I 5		0.80000	0.7631	0.2369	1.0	0.4904	-0.1658	0.3246	0.5074	-0.0253	0.4821
I 6		0.40000	0.7351	0.2649	1.0	0.7389	-0.1288	0.6101	0.2670	-0.1145	0.1425
I 7		0.20000	0.7606	0.2394	1.0	0.4334	-0.1940	0.2394	0.0023	-0.3445	-0.0422
I 8		0.10000	0.7485	0.2515	1.0	0.4439	-0.2120	0.2319	0.0659	-0.0340	0.0319
I 9		0.04650	0.7790	0.2210	1.0	0.4041	-0.1891	0.2150	0.0587	-0.0267	0.0320
I10		0.02150	0.7775	0.2225	1.0	0.3888	-0.1928	0.1960	0.0488	-0.0258	0.0230
I11		0.01000	0.7768	0.2232	1.0	0.3819	-0.1939	0.1880	0.0415	-0.0265	0.0150
I12		0.00465	0.7763	0.2237	1.0	0.3775	-0.1957	0.1818	0.0351	-0.0269	0.0082

			B3 ИЗ I в I+K			B4 ИЗ I в I+K			B5 ИЗ I в I+K		
			B0			B0			B0		
I	II	E МЭВ	ПРИ К РАВНОМ		B3	ПРИ К РАВНОМ		B4	ПРИ К РАВНОМ		B5
I	I		0	1	B0	0	1	B0	0	1	B0
I 1		6.50000	1.3526	0.1634	1.5160	0.7423	-0.3366	0.4057	0.2509	-0.1445	0.1064
I 2		4.00000	0.9420	-0.0638	0.8782	0.3721	-0.1570	0.2151	0.0763	-0.0601	0.0162
I 3		2.50000	0.5683	-0.1476	0.4207	0.1851	-0.0382	0.1469	0.0238	-0.0282	0.0096
I 4		1.40000	0.2371	-0.0041	0.2330	0.0312	-0.0270	0.0042	0.0047	-0.0047	0.0000
I 5		0.80000	0.1101	-0.0521	0.0580	-0.0097	0.0097	0.0000	0.0042	-0.0042	0.0000
I 6		0.40000	0.0311	-0.0311	0.0000	-0.0059	0.0059	0.0000	-0.0037	0.0037	0.0000
I 7		0.20000	-0.0012	0.0012	0.0000	0.0021	-0.0021	0.0000	0.0000	0.0000	0.0000
I 8		0.10000	0.0053	-0.0053	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
I 9		0.04650	0.0045	-0.0045	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
I10		0.02150	0.0032	-0.0032	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
I11		0.01000	0.0021	-0.0021	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
I12		0.00465	0.0010	-0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

	Б0 ИЗ I Б I+К	Б1 ИЗ I Б I+К	Б2 ИЗ I В I+К
	Б1	Б0	В0

II	Б I+Б	ПРИ К РАВНОМ I В0	ПРИ К РАВНОМ I Б1	I Б2
I	I	0 1 I В0	0 1 I Б0	0 1 I Б0
1	6.50000	0.5927 0.4172 1.0	1.1710 -0.3664 0.8046	1.1969 0.0133 1.2102
2	4.00000	0.7330 0.2964 1.0	1.1252 -0.1512 0.9701	1.1489 0.0867 1.2356
3	2.50000	0.8295 0.1705 1.0	0.5734 -0.5241 0.0493	0.9363 0.3462 1.2825
4	1.40000	0.7234 0.2766 1.0	0.4562 -0.1956 0.2606	0.3339 -0.0572 0.2767
5	0.80000	0.7167 0.2833 1.0	0.5930 -0.1962 0.3968	0.1600 -0.0748 0.0852
6	0.40000	0.7680 0.2320 1.0	0.5310 -0.1737 0.3573	0.0979 -0.0542 0.0437
7	0.20000	0.7716 0.2284 1.0	0.4737 -0.1820 0.2917	0.0637 -0.0451 0.0186
8	0.10000	0.7712 0.2288 1.0	0.4278 -0.1916 0.2362	0.0447 -0.0365 0.0082
9	0.04650	0.7968 0.2032 1.0	0.3774 -0.1724 0.2050	0.0354 -0.0281 0.0073
10	0.02150	0.7950 0.2050 1.0	0.3577 -0.1777 0.1800	0.0316 -0.0246 0.0070
11	0.01000	0.7944 0.2056 1.0	0.3515 -0.1795 0.1720	0.0304 -0.0234 0.0070
12	0.00465	0.7940 0.2060 1.0	0.3492 -0.1825 0.1667	0.0297 -0.0227 0.0070

	Б3 ИЗ I В I+К	Б4 ИЗ I В I+К	Б5 ИЗ I В I+К
	В0	В0	В0

II	Б I+Б ИЗВ	ПРИ К РАВНОМ I Б3	ПРИ К РАВНОМ I Б4	ПРИ К РАВНОМ I Б5
I	I	0 1 I В0	0 1 I В0	0 1 I В0
1	6.50000	0.9119 0.1071 1.0210	0.5621 0.1095 0.6716	0.2237 -0.2097 0.0140
2	4.00000	0.9764 -0.0445 0.9319	0.5341 -0.0548 0.4793	0.1254 -0.1161 0.0093
3	2.50000	0.3966 -0.1855 0.2111	-0.0422 -0.0301 -0.0723	-0.0090 0.0254 0.0164
4	1.40000	0.0848 -0.0131 0.0717	0.0318 -0.0092 0.0226	0.0047 -0.0010 0.0037
5	0.60000	0.0422 -0.0080 0.0342	0.0042 -0.0042 0.0000	-0.0002 0.0002 0.0000
6	0.40000	0.0167 -0.0030 0.0137	0.0010 -0.0011 0.0000	-0.0001 0.0001 0.0000
7	0.20000	0.0038 -0.0012 0.0026	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000
8	0.10000	0.0007 -0.0007 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000
9	0.04650	0.0010 -0.0010 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000
10	0.02150	0.0009 -0.0009 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000
11	0.01000	0.0009 -0.0009 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000
12	0.00465	0.0008 -0.0008 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000

Nitrogen

			ВС из I в I+К			В1 из I в I+К			В2 из I в I+К		
			В0			В0			В0		
II	Е мэв	при к равном		В0	при к равном		В1	при к равном		В2
		0	1	В0	0	1	В0	0	1	В0
1	6.50000	0.6312	0.3688	1.0	1.1267	-0.2583	0.8684	1.3386	-0.0122	1.3264
2	4.00000	0.6755	0.3245	1.0	1.0660	-0.3018	0.7642	1.2067	0.3215	1.5282
3	2.50000	0.6719	0.3281	1.0	0.5338	-0.4483	0.0855	1.0486	0.2710	1.3196
4	1.40000	0.7531	0.2469	1.0	0.5703	-0.2076	0.3627	0.2734	0.0161	0.2895
5	0.80000	0.7887	0.2113	1.0	0.4728	-0.1419	0.3309	0.2619	-0.0635	0.1984
6	0.40000	0.7227	0.2773	1.0	0.4341	-0.2290	0.2051	0.0832	-0.0832	0.0000
7	0.20000	0.7853	0.2147	1.0	0.3589	-0.1861	0.1728	0.0285	-0.0285	0.0000
8	0.10000	0.7890	0.2110	1.0	0.3422	-0.1861	0.1561	0.0250	-0.0250	0.0000
9	0.04650	0.8221	0.1779	1.0	0.3029	-0.1574	0.1455	0.0225	-0.0175	0.0050
10	0.02150	0.8219	0.1781	1.0	0.3015	-0.1585	0.1430	0.0221	-0.0171	0.0050
11	0.01000	0.8219	0.1781	1.0	0.3028	-0.1598	0.1430	0.0220	-0.0170	0.0050
12	0.00465	0.8220	0.1780	1.0	0.3035	-0.1606	0.1429	0.0219	-0.0168	0.0051

			В3 из I в I+К			В4 из I в I+К			В5 из I в I+К		
			В0			В0			В0		
II	Е мэв	при к равном		В3	при к равном		В4	при к равном		В5
		0	1	В0	0	1	В0	0	1	В0
1	6.50000	1.2290	0.2133	1.4423	1.1610	0.0682	1.2292	0.4824	-0.2682	0.2142
2	4.00000	0.9524	-0.1397	0.8127	0.5119	-0.1221	0.3898	0.1903	-0.0537	0.1366
3	2.50000	0.4625	-0.1233	0.3392	0.2344	-0.0454	0.1890	0.0465	0.0007	0.0458
4	1.40000	0.1030	-0.0533	0.0497	-0.0150	0.0146	-0.0004	0.0130	-0.0130	0.0000
5	0.80000	0.0464	-0.0095	0.0369	-0.0137	0.0019	-0.0118	0.0045	0.0048	0.0093
6	0.40000	-0.0083	0.0083	0.0000	-0.0319	0.0319	0.0000	-0.0161	0.0161	0.0000
7	0.20000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
8	0.10000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
9	0.04650	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.02150	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11	0.01000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.00465	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

		B0 ИЗ I Б I+К			B1 ИЗ I Б I+К			B2 ИЗ I Б I+К		
		B0			B0			B0		
II	Б ИЗВ	ПРИ К РАВНОМ		B0	ПРИ К РАВНОМ		B1	ПРИ К РАВНОМ		B2
		0	1		0	1	B0	0	1	B0
1	6.50000	0.5921	0.4079	1.0	0.9320	-0.2709	0.6085	0.8517	-0.1151	0.7366
2	4.00000	0.7417	0.2583	1.0	1.0283	-0.1354	0.8929	1.0561	0.0008	1.0569
3	2.50000	0.8280	0.1720	1.0	0.8324	-0.1716	0.6608	0.9727	0.0237	0.9964
4	1.40000	0.7580	0.2420	1.0	0.5485	-0.2115	0.3370	0.4135	0.0306	0.4441
5	0.60000	0.8102	0.1898	1.0	0.4382	-0.2118	0.2264	0.7539	0.0622	0.8161
6	0.40000	0.7490	0.2510	1.0	0.9440	-0.2732	0.6708	0.4172	-0.0104	0.4068
7	0.20000	0.8181	0.1819	1.0	-0.1954	-0.1872	-0.3826	-0.1042	0.0040	-0.1002
8	0.10000	0.8144	0.1856	1.0	0.2002	-0.1737	0.0265	-0.0254	-0.0127	-0.0381
9	0.04650	0.8425	0.1575	1.0	0.2462	-0.1440	0.1022	-0.0017	-0.0136	-0.0153
10	0.02150	0.8434	0.1566	1.0	0.2571	-0.1381	0.1190	-0.0454	-0.0246	-0.0700
11	0.01000	0.8430	0.1564	1.0	0.2629	-0.1409	0.1220	-0.0033	-0.0167	-0.0200
12	0.00465	0.8434	0.1566	1.0	0.2683	-0.1433	0.1250	0.0169	-0.0130	0.0039

		B3 ИЗ I Б I+К			B4 ИЗ I Б I+К			B5 ИЗ I Б I+К		
		B0			B0			B0		
II	Б ИЗВ	ПРИ К РАВНОМ		B3	ПРИ К РАВНОМ		B4	ПРИ К РАВНОМ		B5
		0	1	B0	0	1	B0	0	1	B0
1	6.50000	0.8854	0.1752	1.0606	0.8112	-0.0084	0.8028	0.3777	-0.1278	0.2499
2	4.00000	1.1296	0.0735	1.2031	0.6049	-0.0834	0.5215	0.1429	-0.0908	0.0521
3	2.50000	0.5954	-0.0052	0.5942	0.1223	-0.0112	0.1111	0.0077	-0.0073	0.0004
4	1.40000	0.2023	-0.0184	0.1839	0.1404	-0.0070	0.1334	0.0387	-0.0229	0.0158
5	0.60000	0.1423	-0.0765	0.0658	-0.0427	0.0536	0.0109	-0.0076	-0.0196	-0.0274
6	0.40000	0.0605	0.0199	0.0804	-0.0358	0.0218	-0.0140	-0.0011	0.0011	0.0000
7	0.20000	-0.0378	-0.0074	-0.0452	0.0427	0.0119	0.0546	0.0034	-0.0034	0.0000
8	0.10000	-0.0293	-0.0017	-0.0310	0.0097	0.0035	0.0132	0.0011	-0.0011	0.0000
9	0.04650	-0.0033	0.0010	-0.0023	0.0010	0.0004	0.0014	0.0001	-0.0001	0.0000
10	0.02150	0.0009	-0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11	0.01000	0.0000	-0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.00465	0.0000	-0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

			B0 из 1 в 1+K			B1 из 1 в 1+K			B2 из 1 в 1+K		
			B0			B0			B0		
II	E, эВ	при K равном		B0	при K равном		B1	при K равном		B2
		0	1	B0	0	1	B0	0	1	B0
1	6.50000	0.8489	0.1511	1.0	1.9677	0.0085	1.9762	2.4441	0.0872	2.5313
2	4.00000	0.8484	0.1516	1.0	1.7836	-0.0084	1.7752	2.2049	0.1204	2.3253
3	2.50000	0.8442	0.1558	1.0	1.6007	0.0176	1.6183	1.4625	-0.0176	1.4749
4	1.40000	0.8377	0.1623	1.0	1.3099	-0.0657	1.2442	0.8732	-0.0422	0.8310
5	0.80000	0.8862	0.1138	1.0	1.1508	0.0070	1.1578	0.7836	-0.0359	0.7477
6	0.40000	0.9002	0.0998	1.0	1.3869	0.0211	1.4080	0.8588	-0.0249	0.8339
7	0.20000	0.9147	0.0853	1.0	0.8723	-0.0496	0.8227	0.2871	-0.0370	0.2501
8	0.10000	0.8680	0.1320	1.0	0.4913	-0.0913	0.4000	0.0613	-0.0393	0.0220
9	0.04650	0.8735	0.1265	1.0	0.3539	-0.1039	0.2500	0.0304	-0.0224	0.0080
10	0.02150	0.8698	0.1302	1.0	0.2848	-0.1148	0.1700	0.0200	-0.0150	0.0050
11	0.01000	0.8682	0.1318	1.0	0.2545	-0.1195	0.1350	0.0158	-0.0118	0.0040
12	0.00465	0.8672	0.1328	1.0	0.2285	-0.1233	0.1052	0.0120	-0.0093	0.0027

			B3 из 1 в 1+K			B4 из 1 в 1+K			B5 из 1 в 1+K		
			B0			B0			B0		
II	E, эВ	при K равном		B3	при K равном		B4	при K равном		B5
		0	1	B0	0	1	B0	0	1	B0
1	6.50000	2.6466	0.0206	2.6672	2.5072	0.0574	2.5646	1.7935	0.1123	1.9058
2	4.00000	1.8362	-0.0986	1.7376	1.2691	-0.0442	1.2249	0.6541	-0.0623	0.5918
3	2.50000	0.8043	-0.0899	0.7144	0.3735	-0.0336	0.3399	0.0991	-0.0245	0.0746
4	1.40000	0.4378	-0.0215	0.4163	0.1546	-0.0188	0.1358	0.0119	-0.0116	0.0003
5	0.80000	0.2980	-0.0731	0.2249	0.0304	-0.0040	0.0264	0.0077	-0.0077	0.0000
6	0.40000	0.2044	-0.0875	0.1169	0.0445	-0.0067	0.0378	0.0013	-0.0013	0.0000
7	0.20000	0.0935	0.0041	0.0876	0.0178	-0.0025	0.0153	0.0002	-0.0002	0.0000
8	0.10000	0.0359	0.0041	0.0400	0.0006	-0.0036	0.0000	0.0000	0.0000	0.0000
9	0.04650	0.0153	0.0017	0.0170	0.0014	-0.0014	0.0000	0.0000	0.0000	0.0000
10	0.02150	0.0064	0.0006	0.0070	0.0006	-0.0006	0.0000	0.0000	0.0000	0.0000
11	0.01000	0.0029	0.0001	0.0030	0.0002	-0.0002	0.0000	0.0000	0.0000	0.0000
12	0.00465	0.0002	-0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

	B0 из I в I+K			B1 из I в I+K			B2 из I в I+K		
	B0			B0			B0		
II	при к равном		B0	при к равном		B1	при к равном		B2
I	0	1	I B0	0	1	I B0	0	1	I B0
1	6.50000	0.8496	0.1504	1.0	1.8802	0.0122	1.8924	2.4109	0.0441	2.4550
2	4.00000	0.8486	0.1514	1.0	1.6463	0.0060	1.6523	1.6739	0.0176	1.6915
3	2.50000	0.8573	0.1427	1.0	1.4355	0.0485	1.4840	1.1069	-0.0565	1.0504
4	1.40000	0.8909	0.1091	1.0	0.9815	-0.0671	0.9144	0.6114	-0.0029	0.6085
5	0.80000	0.8599	0.1401	1.0	0.9014	-0.0435	0.8579	0.5863	-0.0243	0.5620
6	0.40000	0.8942	0.1058	1.0	0.4022	-0.0797	0.3225	0.3485	-0.0221	0.3264
7	0.20000	0.8598	0.1402	1.0	0.2759	-0.1298	0.1461	0.0970	0.0057	0.1027
8	0.10000	0.8833	0.1167	1.0	0.2049	-0.1108	0.0941	0.0141	-0.0057	0.0084
9	0.04650	0.8894	0.1106	1.0	0.1939	-0.1039	0.0900	0.0096	-0.0066	0.0030
10	0.02150	0.8898	0.1102	1.0	0.2027	-0.1027	0.1000	0.0095	-0.0072	0.0023
11	0.01000	0.8896	0.1104	1.0	0.1983	-0.1033	0.0950	0.0089	-0.0069	0.0020
12	0.00465	0.8897	0.1103	1.0	0.1908	-0.1038	0.0870	0.0083	-0.0064	0.0019

	B3 из I в I+K			B4 из I в I+K			B5 из I в I+K		
	B0			B0			B0		
II	при к равном		B3	при к равном		B4	при к равном		B5
I	0	1	I B0	0	1	I B0	0	1	I B0
1	6.50000	2.5040	0.0082	2.5122	2.3182	0.0496	2.3678	1.6327	0.0093	1.6420
2	4.00000	1.3026	-0.0827	1.2199	0.8365	-0.0261	0.8104	0.3120	-0.0562	0.2558
3	2.50000	0.5098	-0.0752	0.4346	0.1643	-0.0480	0.1163	0.0149	-0.0114	0.0035
4	1.40000	0.1922	-0.0296	0.1626	0.0076	-0.0068	0.0008	0.0026	-0.0026	0.0000
5	0.80000	0.1257	-0.0568	0.0689	0.0150	-0.0114	0.0036	0.0030	-0.0030	0.0000
6	0.40000	0.0389	0.0054	0.0443	0.0077	-0.0118	-0.0041	0.0014	-0.0014	0.0000
7	0.20000	0.0270	-0.0185	0.0085	0.0557	0.0045	0.0602	0.0005	-0.0005	0.0000
8	0.10000	0.0090	-0.0001	0.0089	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
9	0.04650	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.02150	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11	0.01000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.00465	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Magnesium

	B0 из I в I+K			B1 из I в I+K			B2 из I в I+K		
	B0			B0			B0		
II	E мэВ	при к равном		E0	при к равном		B1	при к равном		B2
I	I	0	1	B0	0	1	B0	0	1	B0
1	6.50000	0.8174	0.1826	1.0	1.6012	0.0242	1.6254	1.4780	0.0390	1.5170
2	4.00000	0.8417	0.1583	1.0	1.3268	-0.1125	1.2143	1.3498	0.0722	1.4220
3	2.50000	0.8036	0.1964	1.0	1.0238	-0.1911	0.8327	1.2495	0.1845	1.4340
4	1.40000	0.9229	0.0771	1.0	1.1158	-0.0193	1.0965	0.9761	-0.0057	0.9704
5	0.80000	0.8834	0.1166	1.0	1.1641	-0.0399	1.1242	0.8544	0.0022	0.8566
6	0.40000	0.8812	0.1188	1.0	1.1173	-0.0607	1.0566	0.8665	-0.0079	0.8586
7	0.20000	0.9033	0.0967	1.0	0.5120	-0.0868	0.4252	0.1061	-0.0061	0.1000
8	0.10000	0.8675	0.1325	1.0	0.2399	-0.1461	0.0938	0.2347	0.0417	0.2764
9	0.04650	0.8892	0.1108	1.0	0.1195	-0.1319	-0.0124	0.3305	0.0395	0.3700
10	0.02150	0.9067	0.0933	1.0	-0.0675	-0.1058	-0.1733	0.0648	0.0140	0.0788
11	0.01000	0.9041	0.0959	1.0	-0.0099	-0.0998	-0.1097	0.0091	0.0048	0.0139
12	0.00465	0.8949	0.1051	1.0	0.1810	-0.0991	0.0819	0.0076	-0.0058	0.0018

	B3 из I в I+K			B4 из I в I+K			B5 из I в I+K		
	B0			B0			B0		
II	E мэВ	при к равном		B3	при к равном		B4	при к равном		B5
I	I	0	1	B0	0	1	B0	0	1	B0
1	6.50000	0.8964	-0.1714	0.7250	0.6900	0.0517	0.7417	0.3941	-0.0874	0.3067
2	4.00000	1.0924	-0.0517	1.0407	0.7078	-0.0044	0.7034	0.1472	-0.0582	0.0890
3	2.50000	0.5831	-0.1729	0.4102	0.3330	0.0212	0.3542	0.1510	-0.0126	0.1384
4	1.40000	0.2993	-0.0309	0.2684	0.0952	-0.0188	0.0764	0.0253	-0.0011	0.0242
5	0.80000	0.2229	-0.0751	0.1478	0.0082	-0.0082	0.0000	-0.0048	0.0048	0.0000
6	0.40000	0.1282	-0.0504	0.0778	-0.0001	0.0001	0.0000	-0.0009	0.0009	0.0000
7	0.20000	0.0279	-0.0023	0.0256	0.0014	-0.0014	0.0000	-0.0001	0.0001	0.0000
8	0.10000	0.0288	-0.0273	0.0015	0.0006	-0.0006	0.0000	-0.0001	0.0001	0.0000
9	0.04650	0.0196	-0.0196	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.02150	0.0015	-0.0015	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11	0.01000	0.0008	-0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.00465	0.0001	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

	B0 ИЗ	Б	I+K	B1 ИЗ	Б	I+K	B2 ИЗ	Б	I+K
	B0			B0			B0		
II E МЭВ	ПРИ К РАВНОМ		B0I	ПРИ К РАВНОМ		B1	ПРИ К РАВНОМ		B2
	0	1		0	1	B0	0	1	B0
1 6.50000	0.8330	0.1670	1.0	1.8350	-0.0489	1.7861	2.3475	0.0863	2.4338
2 4.00000	0.8550	0.1450	1.0	1.5170	-0.0218	1.4952	1.5716	0.0200	1.5916
3 2.50000	0.8554	0.1446	1.0	1.1878	-0.0442	1.1436	1.0623	0.0373	1.0996
4 1.40000	0.9059	0.0941	1.0	1.0645	-0.0323	1.0322	0.7045	-0.0216	0.6829
5 0.80000	0.8865	0.1135	1.0	0.9728	-0.0355	0.9373	0.5295	-0.0426	0.4869
6 0.40000	0.9139	0.0861	1.0	0.6636	-0.0587	0.6049	0.2053	-0.0231	0.1822
7 0.20000	0.8886	0.1114	1.0	0.3965	-0.0901	0.3064	0.0572	-0.0201	0.0371
8 0.10000	0.8991	0.1009	1.0	0.2520	-0.0936	0.1584	0.0188	-0.0068	0.0120
9 0.04650	0.9062	0.0938	1.0	0.1866	-0.0866	0.1000	0.0112	-0.0062	0.0050
10 0.02150	0.9057	0.0943	1.0	0.1711	-0.0881	0.0830	0.0061	-0.0051	0.0030
11 0.01000	0.9055	0.0945	1.0	0.1666	-0.0886	0.0780	0.0069	-0.0049	0.0020
12 0.00465	0.9056	0.0944	1.0	0.1637	-0.0897	0.0740	0.0060	-0.0046	0.0014

	B3 ИЗ	Б	I+K	B4 ИЗ	Б	I+K	B5 ИЗ	Б	I+K
	B0			B0			B0		
II E МЭВ	ПРИ К РАВНОМ		B3	ПРИ К РАВНОМ		B4	ПРИ К РАВНОМ		B5
	0	1	B0	0	1	B0	0	1	B0
1 6.50000	2.2896	-0.0411	2.2485	2.1099	0.0562	2.1661	1.4793	0.0107	1.4900
2 4.00000	1.2229	-0.0640	1.1589	0.8068	-0.0280	0.7780	0.3686	-0.0183	0.3503
3 2.50000	0.5237	-0.0435	0.4802	0.1709	-0.0328	0.1381	0.0678	-0.0102	0.0576
4 1.40000	0.2069	-0.0569	0.1700	0.0615	-0.0044	0.0571	-0.0008	0.0006	0.0000
5 0.80000	0.0819	-0.0330	0.0489	0.0166	-0.0018	0.0148	0.0003	-0.0003	0.0000
6 0.40000	0.0219	-0.0033	0.0186	0.0020	-0.0010	0.0010	-0.0001	0.0001	0.0000
7 0.20000	0.0025	-0.0011	0.0014	-0.0001	0.0001	0.0000	-0.0001	0.0001	0.0000
8 0.10000	-0.0046	-0.0005	-0.0051	-0.0002	0.0002	0.0000	0.0000	0.0000	0.0000
9 0.04650	0.0047	0.0002	0.0049	0.0003	-0.0003	0.0000	0.0000	0.0000	0.0000
10 0.02150	0.0002	-0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11 0.01000	0.0001	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12 0.00465	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

II	E МЭВ	B0 ИЗ I Б I+К			B1 ИЗ I Б I+К			E2 ИЗ I Б I+К		
		B0			B0			B0		
		ПРИ К РАВНОМ		B0I	ПРИ К РАВНОМ		B1	ПРИ К РАВНОМ		E2
		0	1	I B0I	0	1	I B0	0	1	I E0
1	6.50000	0.7707	0.2296	1.0	1.4363	-0.3203	1.1160	2.3257	0.3335	2.6592
2	4.00000	0.8821	0.1179	1.0	1.2621	-0.0479	1.2142	1.8807	0.0364	1.9171
3	2.50000	0.8779	0.1201	1.0	1.3588	-0.0540	1.3048	1.3494	0.0512	1.4006
4	1.40000	0.9095	0.0905	1.0	1.0258	-0.0662	0.9596	0.9228	0.0277	0.9505
5	0.80000	0.8779	0.1201	1.0	0.9619	-0.0610	0.9009	0.4596	-0.0309	0.4287
6	0.40000	0.9123	0.0877	1.0	0.5338	-0.0691	0.4647	0.2271	-0.0186	0.2086
7	0.20000	0.8243	0.1757	1.0	0.3516	-0.1446	0.2070	-0.0332	-0.0028	0.0010
8	0.10000	0.9584	0.0416	1.0	0.1149	-0.0326	0.0823	0.0097	-0.0086	0.0011
9	0.04650	0.9120	0.0880	1.0	0.2472	-0.0772	0.1700	0.0117	-0.0104	0.0013
10	0.02150	0.9110	0.0890	1.0	0.2000	-0.0800	0.1400	0.0099	-0.0086	0.0013
11	0.01000	0.9096	0.0904	1.0	0.1797	-0.0842	0.0950	0.0075	-0.0061	0.0013
12	0.00465	0.9089	0.0911	1.0	0.1581	-0.0867	0.0714	0.0056	-0.0043	0.0012

II	E МЭВ	E3 ИЗ I Б I+К			B4 ИЗ I Б I+К			B5 ИЗ I Б I+К		
		B0			B0			B0		
		ПРИ К РАВНОМ		E3	ПРИ К РАВНОМ		E4	ПРИ К РАВНОМ		B5
		0	1	I E0	0	1	I E0	0	1	I B0
1	6.50000	2.3005	-0.0400	2.2605	2.0187	-0.0745	1.9442	1.6554	0.1846	1.8400
2	4.00000	1.4781	-0.0378	1.4361	1.0497	-0.0327	1.0270	0.7417	0.0146	0.7563
3	2.50000	0.8717	-0.0417	0.8039	0.4462	-0.0382	0.4080	0.2500	-0.0069	0.2431
4	1.40000	0.3157	-0.0085	0.2472	0.1425	0.0202	0.1627	0.0051	-0.0048	0.0003
5	0.80000	0.0459	-0.0226	0.0233	0.0314	-0.0117	0.0197	-0.0030	0.0023	0.0000
6	0.40000	0.0304	-0.0021	0.0283	0.0083	0.0039	0.0121	0.0000	-0.0022	-0.0014
7	0.20000	0.0001	-0.0001	0.0000	0.0007	0.0020	0.0235	0.0017	-0.0017	0.0000
8	0.10000	0.0004	-0.0004	0.0000	0.0069	0.0000	0.0069	0.0000	0.0000	0.0000
9	0.04650	0.0001	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.02150	0.0001	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11	0.01000	0.0001	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.00465	0.0001	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000

	B0 ИЗ I Б I+К	B1 ИЗ I Б I+К	B2 ИЗ I Б I+К
	Б0	Б0	Б0
II Б МЭБ	ПРИ К РАВНОМ I Б0I	ПРИ К РАВНОМ I Б1	ПРИ К РАВНОМ I Б2
I	0 1 I B0I	0 1 I Б0	0 1 I Б0
1 6.50000	0.9330 0.0664 1.0	2.3380 0.1130 2.4510	3.0035 0.1054 3.1089
2 4.00000	0.8977 0.1023 1.0	1.9529 -0.0020 1.9509	2.0423 0.0464 2.0887
3 2.50000	0.9085 0.0915 1.0	1.4281 -0.0320 1.3961	1.4327 0.0436 1.4763
4 1.40000	0.9249 0.0751 1.0	1.1972 -0.0207 1.1765	1.0455 0.0000 1.0455
5 0.60000	0.9196 0.0804 1.0	1.0415 -0.0467 0.9948	0.7344 -0.0046 0.7298
6 0.40000	0.9125 0.0875 1.0	0.9115 -0.0695 0.8420	0.4261 0.0159 0.4420
7 0.20000	0.9272 0.0728 1.0	0.5350 -0.0493 0.4857	0.4509 -0.0124 0.4385
8 0.10000	0.9219 0.0781 1.0	0.5414 -0.0552 0.4862	0.2175 -0.0125 0.2050
9 0.04650	0.9297 0.0703 1.0	0.5388 -0.0488 0.4900	0.1918 -0.0118 0.1800
10 0.02150	0.9283 0.0717 1.0	0.4920 -0.0520 0.4400	0.1615 -0.0115 0.1500
11 0.01000	0.9244 0.0756 1.0	0.3614 -0.0614 0.3000	0.0897 -0.0097 0.0800
12 0.00465	0.9775 0.0625 1.0	0.1434 -0.0789 0.0645	0.0046 -0.0035 0.0011

	B3 ИЗ I Б I+К	B4 ИЗ I Б I+К	B5 ИЗ I Б I+К
	Б0	Б0	Б0
II Б МЭБ	ПРИ К РАВНОМ I Б3	ПРИ К РАВНОМ I Б4	ПРИ К РАВНОМ I Б5
I	0 1 I Б0	0 1 I Б0	0 1 I Б0
1 6.50000	2.8445 0.0435 2.8880	1.7520 -0.1507 1.6019	1.1231 -0.0251 1.0980
2 4.00000	1.3852 -0.0609 1.3243	0.6927 -0.0361 0.5866	0.1489 -0.0527 0.0962
3 2.50000	0.6161 -0.0715 0.5446	0.1838 -0.0247 0.1591	0.0012 -0.0066 -0.0054
4 1.40000	0.2481 -0.0540 0.1951	0.0243 0.0009 0.0252	0.0006 -0.0006 0.0000
5 0.60000	0.0775 -0.0308 0.0467	0.0023 0.0016 0.0039	-0.0003 0.0003 0.0000
6 0.40000	0.0555 -0.0305 0.0250	0.0032 -0.0032 0.0000	-0.0001 0.0001 0.0000
7 0.20000	0.0543 -0.0088 0.0455	0.0022 -0.0022 0.0000	0.0000 0.0000 0.0000
8 0.10000	0.0378 -0.0098 0.0280	0.0007 -0.0007 0.0000	-0.0001 0.0001 0.0000
9 0.04650	0.0125 -0.0085 0.0040	0.0002 -0.0002 0.0000	0.0000 0.0000 0.0000
10 0.02150	0.0074 -0.0074 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000
11 0.01000	0.0039 -0.0039 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000
12 0.00465	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000

	B0 ИЗ I В I+К			B1 ИЗ I В I+К			B2 ИЗ I В I+К		
	B0			B0			B0		
II Е МЭВ	ПРИ К РАВНОМ		B0	ПРИ К РАВНОМ		B1	ПРИ К РАВНОМ		B2
	0	1	B0	0	1	B0	0	1	B0
1 6.50000	0.8690	0.1310	1.0	1.8432	-0.0090	1.8352	2.1288	0.1192	2.2474
2 4.00000	0.9000	0.1000	1.0	1.7807	-0.0264	1.7543	2.0924	0.0675	2.1599
3 2.50000	0.9026	0.0974	1.0	1.2528	-0.0192	1.2336	1.2625	0.0018	1.2643
4 1.40000	0.9331	0.0669	1.0	1.1374	-0.0191	1.1183	0.9744	0.0097	0.9841
5 0.80000	0.9242	0.0758	1.0	1.1265	-0.0098	1.1167	0.7040	-0.0243	0.6797
6 0.40000	0.9265	0.0735	1.0	1.0249	-0.0197	1.0052	0.4813	-0.0377	0.4436
7 0.20000	0.8923	0.1077	1.0	0.7845	-0.0672	0.7173	0.1908	-0.0348	0.1560
8 0.10000	0.9241	0.0759	1.0	0.3864	-0.0645	0.3219	0.0669	-0.0094	0.0575
9 0.04650	0.9234	0.0766	1.0	0.2660	-0.0660	0.2000	0.0478	-0.0078	0.0400
10 0.02150	0.9212	0.0788	1.0	0.1919	-0.0719	0.1200	0.0250	-0.0050	0.0200
11 0.01000	0.9202	0.0798	1.0	0.1548	-0.0748	0.0800	0.0136	-0.0036	0.0100
12 0.00465	0.9199	0.0801	1.0	0.1454	-0.0754	0.0700	0.0094	-0.0034	0.0060
13 0.00215	0.9201	0.0799	1.0	0.1391	-0.0766	0.0625	0.0043	-0.0033	0.0010

	B3 ИЗ I В I+К			B4 ИЗ I В I+К			B5 ИЗ I В I+К		
	B0			B0			B0		
II Е МЭВ	ПРИ К РАВНОМ		B3	ПРИ К РАВНОМ		B4	ПРИ К РАВНОМ		B5
	0	1	B0	0	1	B0	0	1	B0
1 6.50000	1.7257	-0.0886	1.6401	1.1679	-0.0299	1.1380	0.6213	-0.0704	0.5509
2 4.00000	1.3525	-0.0426	1.3099	0.7871	-0.0546	0.7325	0.3238	0.0043	0.3281
3 2.50000	0.5707	-0.0635	0.5072	0.2227	-0.0098	0.2129	0.0740	-0.0075	0.0665
4 1.40000	0.1733	-0.0553	0.1180	0.0404	-0.0014	0.0390	0.0003	-0.0003	0.0000
5 0.80000	0.0726	-0.0393	0.0343	0.0031	-0.0028	0.0003	-0.0004	0.0004	0.0000
6 0.40000	0.0173	-0.0164	0.0009	-0.0004	0.0004	0.0000	-0.0001	0.0001	0.0000
7 0.20000	0.0055	-0.0055	0.0000	0.0001	-0.0001	0.0000	-0.0001	0.0001	0.0000
8 0.10000	0.0020	-0.0020	0.0000	-0.0001	0.0001	0.0000	0.0000	0.0000	0.0000
9 0.04650	0.0020	-0.0020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10 0.02150	0.0010	-0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11 0.01000	0.0005	-0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12 0.00465	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
13 0.00215	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Potassium

		B0 из I в I+K			B1 из I в I+K			B2 из I в I+K		
		B0			B0			B0		
II	E мэв	при K равном		B0	при K равном		B1	при K равном		B2
		0	1	B0	0	1	B0	0	1	B0
1	6.50000	0.8600	0.1400	1.0	1.4589	-0.0764	1.3825	1.7835	0.0386	1.8221
2	4.00000	0.8992	0.1008	1.0	1.3966	-0.0658	1.3308	1.7869	0.0695	1.8564
3	2.50000	0.9233	0.0767	1.0	1.2970	-0.0527	1.2443	1.5051	0.0498	1.5549
4	1.40000	0.9427	0.0573	1.0	1.0675	-0.0449	1.0226	1.1889	0.0338	1.2227
5	0.80000	0.9402	0.0598	1.0	0.9000	-0.0408	0.8592	0.9415	0.0227	0.9642
6	0.40000	0.9356	0.0644	1.0	0.8640	-0.0431	0.8209	0.5991	-0.0037	0.5954
7	0.20000	0.9415	0.0585	1.0	0.4887	-0.0480	0.4407	0.2435	-0.0050	0.2385
8	0.10000	0.9239	0.0761	1.0	0.3256	-0.0654	0.2602	0.0946	-0.0078	0.0868
9	0.04650	0.9370	0.0630	1.0	0.2352	-0.0552	0.1800	0.0455	-0.0055	0.0400
10	0.02150	0.9356	0.0644	1.0	0.1793	-0.0593	0.1200	0.0193	-0.0043	0.0150
11	0.01000	0.9348	0.0652	1.0	0.1416	-0.0616	0.0800	0.0073	-0.0033	0.0040
12	0.00465	0.9342	0.0658	1.0	0.1148	-0.0635	0.0513	0.0029	-0.0022	0.0007

		B3 из I в I+K			B4 из I в I+K			B5 из I в I+K		
		B0			B0			E0		
II	E мэв	при K равном		B3	при K равном		B4	при K равном		B5
		0	1	B0	0	1	B0	0	1	B0
1	6.50000	1.7292	0.0782	1.8074	1.1386	-0.1289	1.0097	0.8988	0.0716	0.9704
2	4.00000	1.4634	-0.0319	1.4315	0.7624	-0.0257	0.7367	0.4255	-0.0157	0.4098
3	2.50000	0.8227	-0.0429	0.7798	0.4440	-0.0205	0.4235	0.1535	-0.0043	0.1492
4	1.40000	0.3773	-0.0373	0.3400	0.0556	-0.0090	0.0466	0.0183	0.0010	0.0193
5	0.80000	0.1394	-0.0399	0.0995	0.0025	-0.0015	0.0010	-0.0001	0.0004	0.0003
6	0.40000	0.0332	-0.0175	0.0157	-0.0001	0.0001	0.0000	-0.0002	0.0002	0.0000
7	0.20000	0.0066	-0.0056	0.0010	-0.0002	0.0002	0.0000	-0.0001	0.0001	0.0000
8	0.10000	0.0029	-0.0029	0.0000	-0.0001	0.0001	0.0000	-0.0001	0.0001	0.0000
9	0.04650	0.0017	-0.0017	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.02150	0.0006	-0.0006	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11	0.01000	0.0002	-0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.00465	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Calcium

	B0 из I в I+K			B1 из I в I+K			B2 из I в I+K		
	B0			B0			B0		
II	E мэв	при K равном 0	при K равном 1	B0I	при K равном 0	при K равном 1	B1 B0	при K равном 0	при K равном 1	B2 B0
1	6.50000	0.8905	0.1095	1.0	1.6085	-0.0345	1.7740	2.3389	0.0906	2.4295
2	4.00000	0.9171	0.0829	1.0	1.6799	-0.0495	1.6304	2.1367	0.1083	2.2450
3	2.50000	0.9246	0.0754	1.0	1.3882	-0.0605	1.5277	1.8290	0.0841	1.9131
4	1.40000	0.9478	0.0522	1.0	0.8684	-0.0612	0.8072	1.2630	0.0544	1.3174
5	0.80000	0.9346	0.0654	1.0	0.8147	-0.0604	0.7543	0.7857	0.0207	0.8064
6	0.40000	0.9520	0.0480	1.0	0.7119	-0.0215	0.6904	0.5245	-0.0104	0.5141
7	0.20000	0.9413	0.0587	1.0	0.3450	-0.0571	0.2879	0.1440	-0.0001	0.1439
8	0.10000	0.9462	0.0538	1.0	0.1643	-0.0499	0.1144	0.0288	-0.0034	0.0254
9	0.04650	0.9373	0.0527	1.0	0.1776	-0.0576	0.1200	0.0164	-0.0044	0.0120
10	0.02150	0.9366	0.0634	1.0	0.1494	-0.0594	0.0900	0.0095	-0.0035	0.0060
11	0.01000	0.9361	0.0639	1.0	0.1306	-0.0606	0.0700	0.0049	-0.0029	0.0020
12	0.00465	0.9358	0.0642	1.0	0.1121	-0.0621	0.0500	0.0028	-0.0021	0.0007

	B3 из I в I+K			B4 из I в I+K			B5 из I в I+K		
	B0			B0			B0		
II	E мэв	при K равном 0	при K равном 1	B3 B0	при K равном 0	при K равном 1	B4 B0	при K равном 0	при K равном 1	B5 B0
1	6.50000	2.2299	-0.0005	2.2294	1.7358	-0.0408	1.6950	1.1081	0.0094	1.1175
2	4.00000	1.4315	-0.0905	1.3410	0.9540	0.0026	0.9566	0.4351	-0.0260	0.4091
3	2.50000	0.8842	-0.0754	0.8088	0.5613	0.0050	0.5663	0.1614	-0.0235	0.1379
4	1.40000	0.2076	-0.0548	0.1528	0.2121	0.0145	0.2266	0.0351	-0.0045	0.0306
5	0.80000	0.0690	-0.0237	0.0453	0.0717	-0.0011	0.0706	0.0067	-0.0007	0.0060
6	0.40000	0.0539	-0.0153	0.0386	0.0085	-0.0006	0.0079	-0.0001	0.0001	0.0000
7	0.20000	0.0029	-0.0016	0.0013	-0.0002	0.0002	0.0000	0.0000	0.0000	0.0000
8	0.10000	0.0005	-0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
9	0.04650	-0.0012	0.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.02150	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11	0.01000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.00465	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

		B0 ИЗ I Б I*K			B1 ИЗ I Б I*K			B2 ИЗ I Б I*K		
		B0			B0			B0		
II	E МЭВ	ПРИ К РАВНОМ		B0I	ПРИ К РАВНОМ		B1	ПРИ К РАВНОМ		B2
I		0	1	B0I	0	1	B0	0	1	B0
1	6.50000	0.9470	0.0530	1.0	2.4164	0.0279	2.4443	3.2387	0.0603	3.2990
2	4.00000	0.9437	0.0563	1.0	2.0019	-0.0159	1.9860	2.5580	0.0451	2.6031
3	2.50000	0.9322	0.0678	1.0	1.4935	-0.0546	1.4389	1.9382	0.0610	1.9992
4	1.40000	0.9488	0.0512	1.0	0.9852	-0.0536	0.9316	1.5169	0.0438	1.5607
5	0.80000	0.9388	0.0612	1.0	0.6699	-0.0503	0.6196	0.8960	0.0231	0.9191
6	0.40000	0.9490	0.0502	1.0	0.4381	-0.0419	0.3962	0.4609	0.0028	0.4637
7	0.20000	0.9430	0.0570	1.0	0.4128	-0.0466	0.3662	0.2868	-0.0058	0.2810
8	0.10000	0.9431	0.0569	1.0	0.2149	-0.0519	0.1630	0.0733	-0.0023	0.0710
9	0.04650	0.9467	0.0533	1.0	0.1163	-0.0513	0.0650	0.0260	-0.0010	0.0250
10	0.02150	0.9465	0.0535	1.0	0.1018	-0.0518	0.0500	0.0094	-0.0014	0.0080
11	0.01000	0.9464	0.0536	1.0	0.0969	-0.0519	0.0450	0.0035	-0.0015	0.0020
12	0.00465	0.9463	0.0537	1.0	0.0938	-0.0522	0.0416	0.0019	-0.0015	0.0004

		B3 ИЗ I Б I*K			B4 ИЗ I Б I*K			B5 ИЗ I Б I*K		
		B0			B0			B0		
II	E МЭВ	ПРИ К РАВНОМ		B3	ПРИ К РАВНОМ		B4	ПРИ К РАВНОМ		B5
I		0	1	B0	0	1	B0	0	1	B0
1	6.50000	3.2144	0.0251	3.2394	2.6352	-0.0208	2.6144	1.6975	0.0302	1.7276
2	4.00000	2.2918	0.0123	2.3041	1.4812	-0.0468	1.4344	0.8262	-0.0019	0.8243
3	2.50000	1.3896	-0.0423	1.3473	0.7165	-0.0104	0.7061	0.3470	-0.0079	0.3391
4	1.40000	0.4714	-0.0392	0.4322	0.2349	0.0015	0.2364	0.0605	-0.0035	0.0570
5	0.80000	0.1427	-0.0340	0.1087	0.0729	0.0024	0.0753	0.0021	-0.0021	0.0000
6	0.40000	0.0544	-0.0107	0.0437	0.0180	-0.0005	0.0176	-0.0001	0.0001	0.0000
7	0.20000	0.0077	-0.0046	0.0031	-0.0001	0.0001	0.0000	0.0000	0.0000	0.0000
8	0.10000	0.0025	-0.0025	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
9	0.04650	0.0008	-0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.02150	0.0003	-0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11	0.01000	0.0001	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.00465	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Vanadium

		B0 ИЗ I Б I*К			B1 ИЗ I Б I*К			B2 ИЗ I Б I*К		
		B0			B0			B0		
II	E МЭВ	ПРИ К РАВНОМ		B0	ПРИ К РАВНОМ		B1	ПРИ К РАВНОМ		B2
		0	1	B0	0	1	B0	0	1	B0
1	6.50000	0.9515	0.0485	1.0	2.3949	0.0313	2.4252	3.1765	0.0531	3.2296
2	4.00000	0.9527	0.0473	1.0	2.1236	-0.0004	2.1232	2.5772	0.0153	2.5925
3	2.50000	0.9383	0.0617	1.0	1.4913	-0.0431	1.4482	1.9846	0.0468	2.0314
4	1.40000	0.9583	0.0417	1.0	1.0783	-0.0450	1.0333	1.5562	0.0449	1.6011
5	0.80000	0.9402	0.0598	1.0	0.6234	-0.0628	0.5606	1.0143	0.0318	1.0461
6	0.40000	0.9378	0.0622	1.0	0.4733	-0.0520	0.4213	0.3821	-0.0039	0.3782
7	0.20000	0.9246	0.0754	1.0	0.2482	-0.0678	0.1804	0.0517	-0.0069	0.0448
8	0.10000	0.9848	0.0152	1.0	0.1086	-0.0148	0.0938	0.0120	-0.0004	0.0116
9	0.04650	0.9499	0.0501	1.0	0.1032	-0.0482	0.0550	0.0057	-0.0017	0.0040
10	0.02150	0.9498	0.0502	1.0	0.0966	-0.0486	0.0480	0.0036	-0.0016	0.0020
11	0.01000	0.9497	0.0503	1.0	0.0918	-0.0488	0.0430	0.0025	-0.0015	0.0010
12	0.00465	0.9494	0.0506	1.0	0.0884	-0.0492	0.0392	0.0017	-0.0013	0.0004

		B3 ИЗ I Б I*К			B4 ИЗ I Б I*К			B5 ИЗ I Б I*К		
		B0			B0			B0		
II	E МЭВ	ПРИ К РАВНОМ		B3	ПРИ К РАВНОМ		B4	ПРИ К РАВНОМ		B5
		0	1	B0	0	1	B0	0	1	B0
1	6.50000	3.1750	0.0184	3.1934	2.6065	0.0025	2.6090	1.5722	-0.0107	1.5615
2	4.00000	2.3749	0.0271	2.4020	1.5558	-0.0192	1.5366	0.6479	-0.0399	0.6080
3	2.50000	1.6509	-0.0326	1.6263	1.0016	0.0107	1.0123	0.2422	-0.0348	0.2074
4	1.40000	0.7821	-0.0443	0.7378	0.6690	0.0185	0.7075	0.0213	-0.0160	0.0053
5	0.80000	0.1816	-0.0269	0.1547	0.1918	0.0003	0.1921	0.0018	-0.0018	0.0000
6	0.40000	0.0394	-0.0065	0.0329	0.0066	0.0003	0.0069	-0.0001	0.0001	0.0000
7	0.20000	0.0007	-0.0007	0.0000	0.0000	0.0000	0.0000	-0.0001	0.0001	0.0000
8	0.10000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
9	0.04650	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.02150	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11	0.01000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.00465	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

			B0 из I в I+K			B1 из I в I+K			B2 из I в I+K		
			B0			B0			B0		
II	I	E мэВ	при K равном		B0	при K равном		B1	при K равном		B2
			0	1	B0	0	1	B0	0	1	B0
1	1	6.50000	0.9559	0.0441	1.0	2.3895	0.0288	2.4183	3.2457	0.0381	3.2838
2	2	4.00000	0.9410	0.0590	1.0	2.0548	-0.0303	2.0245	2.5721	0.0385	2.6106
3	3	2.50000	0.9397	0.0603	1.0	1.3838	-0.0526	1.3312	1.9008	0.0404	1.9412
4	4	1.40000	0.9439	0.0561	1.0	1.0253	-0.0675	0.9578	1.4924	0.0490	1.5414
5	5	0.80000	0.9385	0.0615	1.0	0.6116	-0.0368	0.5748	0.8810	-0.0088	0.8722
6	6	0.40000	0.9633	0.0367	1.0	0.5168	-0.0359	0.4809	0.4321	0.0086	0.4407
7	7	0.20000	0.9318	0.0682	1.0	0.3832	-0.0555	0.3277	0.1853	-0.0097	0.1756
8	8	0.10000	0.9465	0.0535	1.0	0.2289	-0.0489	0.1800	0.0413	-0.0039	0.0374
9	9	0.04650	0.9515	0.0485	1.0	0.1549	-0.0449	0.1100	0.0170	-0.0030	0.0140
10	0	0.02150	0.9508	0.0492	1.0	0.1119	-0.0469	0.0650	0.0069	-0.0019	0.0050
11	1	0.01000	0.9505	0.0495	1.0	0.0929	-0.0479	0.0450	0.0034	-0.0014	0.0020
12	0	0.00465	0.9504	0.0496	1.0	0.0868	-0.0483	0.0385	0.0016	-0.0013	0.0003

			B3 из I в I+K			B4 из I в I+K			B5 из I в I+K		
			B0			B0			B0		
II	I	E мэВ	при K равном		B3	при K равном		B4	при K равном		B5
			0	1	B0	0	1	B0	0	1	B0
1	1	6.50000	3.3034	0.0178	3.3518	2.8736	0.0354	2.9090	1.7738	-0.0057	1.7681
2	2	4.00000	2.4675	0.0029	2.4704	1.9443	0.0213	1.9656	0.7940	-0.0627	0.7313
3	3	2.50000	1.5436	0.0028	1.5464	0.8834	-0.0295	0.8539	0.1489	-0.0201	0.1288
4	4	1.40000	0.7047	-0.0360	0.6687	0.2818	0.0084	0.2902	0.0145	-0.0131	0.0014
5	5	0.80000	0.2367	-0.0235	0.2132	0.1557	0.0104	0.1661	0.0031	-0.0031	0.0000
6	6	0.40000	0.1192	-0.0100	0.1092	0.0441	0.0019	0.0460	0.0010	-0.0010	0.0000
7	7	0.20000	0.0034	-0.0029	0.0005	0.0288	0.0000	0.0288	0.0000	0.0000	0.0000
8	8	0.10000	0.0008	-0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
9	9	0.04650	0.0004	-0.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	0	0.02150	0.0002	-0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11	1	0.01000	0.0001	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0	0.00465	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Manganese

		B0 из I в I+K			B1 из I в I+K			B2 из I в I+K		
		B0			B0			B0		
I	II E мэВ	при к равном		B0	при к равном		B1	при к равном		B2
I	I	0	1	B0	0	1	B0	0	1	B0
I 1	6.50000	0.9578	0.0422	1.0	2.3526	0.0175	2.3701	3.1669	0.0445	3.2114
I 2	4.00000	0.9415	0.0585	1.0	1.8249	-0.0273	1.7976	2.3599	0.0227	2.3826
I 3	2.50000	0.9435	0.0565	1.0	1.3275	-0.0415	1.2860	1.6554	0.0216	1.6770
I 4	1.40000	0.9517	0.0483	1.0	0.8929	-0.0492	0.8437	1.2648	0.0281	1.2929
I 5	0.80000	0.9486	0.0514	1.0	0.5784	-0.0445	0.5339	0.7818	0.0112	0.7930
I 6	0.40000	0.9476	0.0524	1.0	0.4627	-0.0441	0.4186	0.3263	-0.0027	0.3236
I 7	0.20000	0.9480	0.0520	1.0	0.2497	-0.0486	0.2011	0.1010	-0.0015	0.0995
I 8	0.10000	0.9760	0.0240	1.0	0.1088	-0.0234	0.0854	0.0309	-0.0006	0.0303
I 9	0.04650	0.9568	0.0432	1.0	0.0930	-0.0430	0.0500	0.0110	-0.0010	0.0100
I10	0.02150	0.9567	0.0433	1.0	0.0882	-0.0432	0.0450	0.0061	-0.0011	0.0050
I11	0.01000	0.9566	0.0434	1.0	0.0834	-0.0434	0.0400	0.0050	-0.0010	0.0040
I12	0.00465	0.9531	0.0469	1.0	0.0821	-0.0458	0.0363	0.0815	-0.0011	0.0004

		B3 из I в I+K			B4 из I в I+K			B5 из I в I+K		
		B0			B0			B0		
I	II E мэВ	при к равном		B3	при к равном		B4	при к равном		B5
I	I	0	1	B0	0	1	B0	0	1	B0
I 1	6.50000	3.2771	0.0135	3.2906	2.9073	0.0228	2.9301	1.9328	0.0360	1.9688
I 2	4.00000	2.2605	0.0115	2.2720	1.7040	-0.0073	1.6967	0.8653	-0.0209	0.8444
I 3	2.50000	1.4273	0.0025	1.4298	0.8096	-0.0190	0.7906	0.2944	-0.0087	0.2857
I 4	1.40000	0.7937	-0.0130	0.7807	0.2888	-0.0091	0.2797	0.0705	-0.0045	0.0660
I 5	0.80000	0.2997	-0.0142	0.2885	0.0896	-0.0021	0.0875	0.0015	-0.0015	0.0000
I 6	0.40000	0.0604	-0.0050	0.0554	0.0208	-0.0002	0.0206	0.0001	-0.0001	0.0000
I 7	0.20000	0.0075	-0.0018	0.0057	0.0005	0.0000	0.0005	-0.0001	0.0001	0.0000
I 8	0.10000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
I 9	0.04650	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
I10	0.02150	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
I11	0.01000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
I12	0.00465	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

			B0 из	в	I-к		B1 из	в	I-к		B2 из	в	I-к	
				B0				b0				0		
I	II	E мэв	при к	равном		B0	при к	равном		B1	при к	равном		B2
I	I		0	1	I	B0	0	1	I	B0	0	1	I	b0
I 1		6.50000	0.9534	0.0466		1.0	2.3469	0.0156		2.3625	3.1740	0.0413		3.2153
I 2		4.00000	0.9526	0.0474		1.0	2.0676	-0.0096		2.0580	2.5501	0.0134		2.5635
I 3		2.50000	0.9306	0.0694		1.0	1.4703	-0.0575		1.4328	1.9154	0.0546		1.9700
I 4		1.40000	0.9603	0.0397		1.0	0.9260	-0.0415		0.8845	1.4397	0.0369		1.4766
I 5		0.80000	0.9369	0.0631		1.0	0.7515	-0.0397		0.7119	0.9823	0.0223		1.0046
I 6		0.40000	0.9414	0.0586		1.0	0.4717	-0.0584		0.4133	0.4224	0.0031		0.4255
I 7		0.20000	0.9459	0.0541		1.0	0.3507	-0.0408		0.3099	0.1534	-0.0100		0.1434
I 8		0.10000	0.9493	0.0507		1.0	0.3026	-0.0386		0.2640	0.0565	-0.0065		0.0500
I 9		0.04650	0.9581	0.0419		1.0	0.1795	-0.0395		0.1400	0.0233	-0.0033		0.0200
I10		0.02150	0.9572	0.0428		1.0	0.1218	-0.0418		0.0800	0.0120	-0.0020		0.0100
I11		0.01000	0.9561	0.0439		1.0	0.0929	-0.0429		0.0500	0.0063	-0.0013		0.0050
I12		0.00465	0.9539	0.0461		1.0	0.0807	-0.0450		0.0357	0.0014	-0.0011		0.0003

			B3 из	в	I-к		B4 из	в	I-к		B5 из	в	I-к	
				B				B0				b0		
I	II	E мэв	при к	равном		B3	при к	равном		B4	при к	равном		B5
I	I		0	1	I	B0	0	1	I	B0	0	1	I	B0
I 1		6.50000	3.3152	0.0104		3.3256	3.0457	0.0241		3.0698	1.9858	0.0319		2.0177
I 2		4.00000	2.3185	0.0165		2.3350	1.5821	-0.0145		1.5676	0.8391	-0.0305		0.8086
I 3		2.50000	1.6011	-0.0325		1.5686	0.8743	0.0140		0.8883	0.1647	-0.0465		0.1182
I 4		1.40000	0.9076	-0.0263		0.8813	0.3769	0.0045		0.3814	0.0126	-0.0126		0.0000
I 5		0.80000	0.3854	-0.0406		0.3448	0.1783	0.0024		0.1807	0.0058	-0.0058		0.0000
I 6		0.40000	0.0470	-0.0039		0.0431	0.0724	0.0012		0.0736	0.0006	-0.0006		0.0000
I 7		0.20000	0.0239	-0.0033		0.0206	0.0025	0.0000		0.0025	0.0000	0.0000		0.0000
I 8		0.10000	0.0014	-0.0014		0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
I 9		0.04650	0.0006	-0.0006		0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
I10		0.02150	0.0003	-0.0003		0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
I11		0.01000	0.0001	-0.0001		0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
I12		0.00465	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000

			B0 ИЗ I В I+К			B1 ИЗ I Б I+К			B2 ИЗ I В I+К		
			B0			B0			B0		
II	Е МЭВ	ПРИ К РАВНОМ 0	ПРИ К РАВНОМ 1	B0	ПРИ К РАВНОМ 0	ПРИ К РАВНОМ 1	B1 B0	ПРИ К РАВНОМ 0	ПРИ К РАВНОМ 1	B2 B0
1	6.50000	0.9592	0.0408	1.0	2.3231	0.0087	2.3318	3.1852	0.0354	3.2206
2	4.00000	0.9605	0.0395	1.0	2.0383	-0.0074	2.0309	2.6272	0.0068	2.6340
3	2.50000	0.9441	0.0559	1.0	1.3588	-0.0365	1.3223	1.6563	0.0049	1.6612
4	1.40000	0.9481	0.0519	1.0	0.8465	-0.0496	0.7969	1.0974	0.0265	1.1239
5	0.80000	0.9446	0.0554	1.0	0.5594	-0.0521	0.5073	0.7559	0.0149	0.7708
6	0.40000	0.9554	0.0446	1.0	0.3836	-0.0403	0.3433	0.3400	0.0025	0.3425
7	0.20000	0.9460	0.0532	1.0	0.2560	-0.0491	0.2069	0.1373	-0.0018	0.1355
8	0.10000	0.9527	0.0473	1.0	0.1409	-0.0449	0.0960	0.0383	-0.0013	0.0370
9	0.04650	0.9563	0.0437	1.0	0.0921	-0.0421	0.0500	0.0158	-0.0008	0.0150
10	0.02150	0.9561	0.0439	1.0	0.0729	-0.0429	0.0300	0.0076	-0.0006	0.0070
11	0.01000	0.9561	0.0439	1.0	0.0700	-0.0430	0.0270	0.0037	-0.0007	0.0030
12	0.00465	0.9562	0.0438	1.0	0.0767	-0.0428	0.0339	0.0013	-0.0010	0.0003

			B3 ИЗ I В I+К			B4 ИЗ I Б I+К			B5 ИЗ I В I+К		
			B0			B0			B0		
II	Е МЭВ	ПРИ К РАВНОМ 0	ПРИ К РАВНОМ 1	B0	ПРИ К РАВНОМ 0	ПРИ К РАВНОМ 1	B4 B0	ПРИ К РАВНОМ 0	ПРИ К РАВНОМ 1	B5 B0
1	6.50000	3.3258	0.0247	3.3505	2.9919	0.0237	3.0156	2.0382	0.0404	2.0786
2	4.00000	2.7652	0.0320	2.7972	2.1126	-0.0104	2.1022	1.1061	-0.0237	1.0824
3	2.50000	1.5349	0.0032	1.5381	0.8692	-0.0094	0.8598	0.3174	-0.0136	0.3038
4	1.40000	0.6605	-0.0149	0.6516	0.3337	-0.0046	0.3291	0.0300	-0.0093	0.0207
5	0.80000	0.3145	-0.0148	0.2997	0.1222	-0.0006	0.1216	0.0027	-0.0027	0.0000
6	0.40000	0.0748	-0.0067	0.0681	0.0438	0.0007	0.0445	0.0007	-0.0007	0.0000
7	0.20000	0.0095	-0.0025	0.0070	0.0175	0.0005	0.0180	0.0003	-0.0003	0.0000
8	0.10000	0.0012	-0.0012	0.0000	0.0057	0.0003	0.0060	0.0002	-0.0002	0.0000
9	0.04650	0.0005	-0.0005	0.0000	0.0028	0.0002	0.0030	0.0000	0.0000	0.0000
10	0.02150	0.0002	-0.0002	0.0000	0.0019	0.0001	0.0020	0.0000	0.0000	0.0000
11	0.01000	0.0001	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.00465	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

			B0 ИЗ I I I-K			B1 ИЗ I Б I-K			B2 ИЗ I Б I-K		
			B0			B1			B2		
I	I	E МэВ	ПРИ К РАВНОМ		B0	ПРИ К РАВНОМ		B1	ПРИ К РАВНОМ		B2
I	I		0	1	I B0	0	1	I B0	0	1	I B0
I 1		6.50000	0.9517	0.0483	1.0	2.3570	0.0064	2.3634	3.3418	0.0271	3.3689
I 2		4.00000	0.9470	0.0530	1.0	1.8271	-0.0245	1.8026	2.2296	0.0114	2.2410
I 3		2.50000	0.9563	0.0437	1.0	1.3806	-0.0349	1.3456	1.8682	0.0442	1.9124
I 4		1.40000	0.9452	0.0548	1.0	0.9923	-0.0630	0.9293	1.4715	0.0464	1.5179
I 5		0.80000	0.9474	0.0526	1.0	0.4767	-0.0520	0.4247	0.9512	0.0202	0.9714
I 6		0.40000	0.9504	0.0496	1.0	0.4389	-0.0433	0.3956	0.4104	0.0001	0.4105
I 7		0.20000	0.9455	0.0545	1.0	0.2954	-0.0474	0.2480	0.1058	-0.0061	0.0997
I 8		0.10000	0.9454	0.0546	1.0	0.1652	-0.0521	0.1131	0.0191	-0.0024	0.0167
I 9		0.04650	0.9560	0.0432	1.0	0.0930	-0.0430	0.0500	0.0073	-0.0013	0.0060
I10		0.02150	0.9560	0.0434	1.0	0.0833	-0.0433	0.0400	0.0041	-0.0011	0.0030
I11		0.01000	0.9565	0.0435	1.0	0.0785	-0.0435	0.0350	0.0030	-0.0010	0.0020
I12		0.00465	0.9562	0.0438	1.0	0.0767	-0.0428	0.0339	0.0013	-0.0010	0.0003

			B3 ИЗ I Б I-K			B4 ИЗ I Б I-K			B5 ИЗ I Б I-K		
			B0			B0			B0		
I	I	E МэВ	ПРИ К РАВНОМ		B3	ПРИ К РАВНОМ		B4	ПРИ К РАВНОМ		B5
I	I		0	1	I B0	0	1	I B0	0	1	I B0
I 1		6.50000	3.4750	0.0299	3.5049	3.1520	0.0305	3.1825	2.1422	0.0357	2.1779
I 2		4.00000	2.3100	0.0094	2.3194	1.9000	0.0122	1.9122	0.9556	-0.0323	0.9233
I 3		2.50000	1.4184	-0.0207	1.3977	0.9430	-0.0027	0.9403	0.2033	-0.0269	0.1764
I 4		1.40000	0.7810	-0.0281	0.7529	0.3851	-0.0027	0.3824	0.0086	-0.0073	0.0013
I 5		0.80000	0.2376	-0.0199	0.2177	0.1256	0.0024	0.1280	0.0031	-0.0031	0.0000
I 6		0.40000	0.0648	-0.0060	0.0588	0.0581	0.0009	0.0590	0.0011	-0.0011	0.0000
I 7		0.20000	0.0245	-0.0008	0.0237	0.0226	0.0004	0.0230	0.0004	-0.0004	0.0000
I 8		0.10000	0.0081	-0.0001	0.0080	0.0079	0.0001	0.0080	0.0001	-0.0001	0.0000
I 9		0.04650	0.0031	-0.0001	0.0030	0.0029	0.0001	0.0030	0.0001	-0.0001	0.0000
I10		0.02150	0.0011	-0.0001	0.0010	0.0010	0.0000	0.0010	0.0000	0.0000	0.0000
I11		0.01000	0.0004	0.0000	0.0004	0.0004	0.0000	0.0004	0.0000	0.0000	0.0000
I12		0.00465	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Copper

			B0 ИЗ I B I-K			B1 ИЗ I B I-K			B2 ИЗ I B I-K		
			BC			B0			BC		
	I	E гр.	ПРИ К РАВНОМ		B0	ПРИ К РАВНОМ		B1	ПРИ К РАВНОМ		B2
	II	ниже.	0	1	EO	0	1	BC	0	1	B0
1	1	6.50000	0.9743	0.0257	1.0000	2.5326	0.0320	2.5646	3.4190	0.0395	3.4585
2	2	4.00000	0.9622	0.0378	1.0000	2.1228	-0.0134	2.1094	2.7824	0.0145	2.7969
3	3	2.50000	0.9563	0.0437	1.0000	1.5761	-0.0251	1.5510	1.9189	-0.0013	1.9176
4	4	1.40000	0.9489	0.0511	1.0000	1.0120	-0.0452	0.9668	1.2136	0.0171	1.2307
5	5	0.80000	0.9449	0.0551	1.0000	0.6048	-0.0451	0.5597	0.6412	0.0026	0.6438
6	6	0.40000	0.9565	0.0435	1.0000	0.4224	-0.0366	0.3858	0.2834	-0.0028	0.2806
7	7	0.20000	0.9523	0.0477	1.0000	0.2885	-0.0426	0.2459	0.1019	-0.0043	0.0976
8	8	0.10000	0.9522	0.0478	1.0000	0.1516	-0.0455	0.1061	0.0204	-0.0018	0.0186
9	9	0.04650	0.9592	0.0408	1.0000	0.0695	-0.0395	0.0300	0.0110	-0.0010	0.0100
10	10	0.02150	0.9591	0.0409	1.0000	0.0798	-0.0398	0.0400	0.0069	-0.0009	0.0060
11	11	0.01000	0.9589	0.0411	1.0000	0.0702	-0.0402	0.0300	0.0047	-0.0007	0.0040
12	12	0.00465	0.9596	0.0404	1.0000	0.0708	-0.0395	0.0313	0.0011	-0.0008	0.0003

			B3 ИЗ I B I-K			B4 ИЗ I B I-K			B5 ИЗ I B I-K		
			BC			B0			BC		
	I	E гр.	ПРИ К РАВНОМ		B3	ПРИ К РАВНОМ		B4	ПРИ К РАВНОМ		B5
	II	ниже.	0	1	EO	0	1	BC	0	1	B0
1	1	6.50000	3.4646	-0.0140	3.4506	3.2353	0.0351	3.2704	2.3230	0.0660	2.3890
2	2	4.00000	2.7229	0.0169	2.7398	2.3307	0.0083	2.3390	1.3759	-0.0174	1.3585
3	3	2.50000	2.0819	0.0375	2.1194	1.3200	-0.0151	1.3049	0.4621	-0.0310	0.4311
4	4	1.40000	1.0070	-0.0109	0.9961	0.4645	-0.0010	0.4635	0.0873	-0.0093	0.0780
5	5	0.80000	0.2995	-0.0095	0.2900	0.1353	-0.0011	0.1342	0.0162	-0.0019	0.0143
6	6	0.40000	0.0799	-0.0028	0.0771	0.0313	-0.0007	0.0306	0.0005	-0.0005	0.0000
7	7	0.20000	0.0395	-0.0014	0.0381	0.0369	0.0015	0.0384	0.0008	-0.0008	0.0000
8	8	0.10000	0.0007	-0.0007	0.0000	0.0208	0.0007	0.0215	0.0004	-0.0004	0.0000
9	9	0.04650	0.0004	-0.0004	0.0000	0.0096	0.0004	0.0100	0.0002	-0.0002	0.0000
10	10	0.02150	0.0002	-0.0002	0.0000	0.0046	0.0002	0.0050	0.0000	0.0000	0.0000
11	11	0.01000	0.0000	0.0000	0.0000	0.0019	0.0001	0.0020	0.0000	0.0000	0.0000
12	12	0.00465	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Zinc

II	E МЭВ	B0 ИЗ I B I+K: ПРИ К РАВНОМ 0	ПРИ К РАВНОМ 1	B0	B1 ИЗ I B I+K: ПРИ К РАВНОМ 0	ПРИ К РАВНОМ 1	B1 B0	B2 ИЗ I B I+K: ПРИ К РАВНОМ 0	ПРИ К РАВНОМ 1	B2 B0
1	6.50000	0.9650	0.0350	1.0	2.3773	0.0020	2.3793	3.3403	0.0440	3.3843
2	4.00000	0.9576	0.0424	1.0	1.9391	-0.0261	1.9130	2.6952	0.0163	2.7115
3	2.50000	0.9613	0.0387	1.0	1.5288	-0.0262	1.5026	2.1326	0.0210	2.1563
4	1.40000	0.9515	0.0485	1.0	1.1147	-0.0425	1.0722	1.4732	0.0190	1.4922
5	0.80000	0.9468	0.0532	1.0	0.5833	-0.0452	0.5381	0.6346	0.0076	0.6422
6	0.40000	0.9570	0.0430	1.0	0.4233	-0.0386	0.3847	0.3564	0.0035	0.3599
7	0.20000	0.9557	0.0443	1.0	0.2723	-0.0421	0.2302	0.2214	0.0021	0.2235
8	0.10000	0.9546	0.0454	1.0	0.1594	-0.0443	0.1151	0.1140	0.0011	0.1151
9	0.04650	0.9606	0.0394	1.0	0.0987	-0.0387	0.0600	0.0592	0.0008	0.0600
10	0.02150	0.9603	0.0394	1.0	0.0791	-0.0391	0.0400	0.0299	0.0001	0.0300
11	0.01000	0.9603	0.0397	1.0	0.0740	-0.0390	0.0350	0.0153	-0.0003	0.0150
12	0.00465	0.9602	0.0398	1.0	0.0700	-0.0400	0.0300	0.0010	-0.0008	0.0002

II	E МЭВ	B3 ИЗ I B I+K: ПРИ К РАВНОМ 0	ПРИ К РАВНОМ 1	B3 B0	B4 ИЗ I B I+K: ПРИ К РАВНОМ 0	ПРИ К РАВНОМ 1	B4 B0	B5 ИЗ I B I+K: ПРИ К РАВНОМ 0	ПРИ К РАВНОМ 1	B5 B0
1	6.50000	3.5960	0.0013	3.5973	3.4358	0.0456	3.4814	2.4775	0.0674	2.5449
2	4.00000	2.8338	0.0309	2.8647	2.3373	-0.0138	2.3235	1.5281	0.0081	1.5362
3	2.50000	2.1029	0.0068	2.1097	1.4448	-0.0008	1.4440	0.7233	-0.0130	0.7103
4	1.40000	1.1579	-0.0134	1.1445	0.7011	-0.0064	0.6947	0.2845	-0.0013	0.2832
5	0.80000	0.2017	-0.0141	0.1876	0.1031	0.0005	0.1036	0.0291	-0.0017	0.0274
6	0.40000	0.0588	-0.0069	0.0519	0.0296	-0.0004	0.0292	0.0003	-0.0003	0.0000
7	0.20000	0.0324	-0.0038	0.0286	0.0079	-0.0004	0.0075	-0.0001	0.0001	0.0000
8	0.10000	0.0125	-0.0020	0.0105	0.0010	-0.0010	0.0000	0.0000	0.0000	0.0000
9	0.04650	0.0033	-0.0013	0.0020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.02150	0.0007	-0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11	0.01000	0.0004	-0.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.00465	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

			B0 ИЗ I В I+К			B1 ИЗ I В I+К			B2 ИЗ I В I+К		
			B0			B0			B0		
II	Е МЭВ	I ПРИ К РАВНОМ		B0	ПРИ К РАВНОМ		B1	ПРИ К РАВНОМ		B2	
		I 0	1	B0	0	1	B0	0	1	B0	
1	6.50000	0.9733	0.0267	1.0	2.3939	0.0096	2.4035	3.1787	0.0045	3.1832	
2	4.00000	0.9571	0.0429	1.0	1.6325	-0.0203	1.6122	2.0604	0.0128	2.0732	
3	2.50000	0.9558	0.0442	1.0	1.2178	-0.0295	1.1883	1.3458	0.0123	1.3581	
4	1.40000	0.9692	0.0308	1.0	1.0301	-0.0134	1.0167	1.0007	-0.0004	1.0003	
5	0.80000	0.9689	0.0311	1.0	1.0523	-0.0034	1.0489	0.4582	-0.0201	0.4381	
6	0.40000	0.9758	0.0242	1.0	0.9448	-0.0060	0.9388	0.1392	-0.0171	0.1221	
7	0.20000	0.9745	0.0255	1.0	0.6860	-0.0155	0.6705	0.0481	-0.0095	0.0386	
8	0.10000	0.9706	0.0294	1.0	0.3828	-0.0243	0.3585	0.0274	-0.0047	0.0227	
9	0.04650	0.9730	0.0270	1.0	0.2035	-0.0235	0.1800	0.0170	-0.0030	0.0140	
10	0.02150	0.9722	0.0278	1.0	0.1160	-0.0260	0.0900	0.0085	-0.0015	0.0070	
11	0.01000	0.9718	0.0282	1.0	0.0771	-0.0271	0.0500	0.0039	-0.0009	0.0030	
12	0.00465	0.9709	0.0291	1.0	0.0512	-0.0287	0.0225	0.0005	-0.0004	0.0001	

			B3 ИЗ I В I+К			B4 ИЗ I В I+К			B5 ИЗ I В I+К		
			B0			B0			B0		
II	Е МЭВ	I ПРИ К РАВНОМ		B3	ПРИ К РАВНОМ		B4	ПРИ К РАВНОМ		B5	
		I 0	1	B0	0	1	B0	0	1	B0	
1	6.50000	3.5335	0.0048	3.5383	3.6368	0.0132	3.6500	3.2578	0.1315	3.3893	
2	4.00000	1.9369	-0.0388	1.8981	2.2700	0.0422	2.3122	1.9156	0.0203	1.9359	
3	2.50000	0.9330	-0.0338	0.8992	1.4029	0.0430	1.4459	0.6445	-0.0246	0.6199	
4	1.40000	0.4390	-0.0134	0.4256	0.4429	-0.0025	0.4404	0.0845	-0.0808	0.0037	
5	0.80000	0.0560	-0.0074	0.0486	0.0052	0.0001	0.0053	-0.0001	0.0001	0.0000	
6	0.40000	0.0010	-0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
7	0.20000	0.0004	-0.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
8	0.10000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
9	0.04650	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
10	0.02150	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
11	0.01000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
12	0.00465	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	

			B0 ИЗ I Б I+К			B1 ИЗ I Б I+К			B2 ИЗ I Б I+К		
			B0			B0			B0		
II	Б МЭВ	ПРИ I РАВНОМ		I B0	ПРИ К РАВНОМ		B1	ПРИ К РАВНОМ		I B2
I	I	0	1	I B0	0	1	P0	0	1	I B0
1	6.50000	0.9670	0.0324	1.0	2.2726	-0.0043	2.2683	3.0989	0.0134	3.1123
2	4.00000	0.9621	0.0379	1.0	1.6224	-0.0131	1.6093	2.0366	0.0025	2.0391
3	2.50000	0.9605	0.0395	1.0	1.3439	-0.0241	1.3198	1.4787	0.0156	1.4943
4	1.40000	0.9734	0.0266	1.0	1.1119	-0.0103	1.1016	1.2490	0.0071	1.2561
5	0.80000	0.9696	0.0304	1.0	1.1290	-0.0099	1.1191	0.9379	-0.0017	0.9362
6	0.40000	0.9725	0.0275	1.0	0.9179	-0.0186	0.8993	0.6137	0.0002	0.6139
7	0.20000	0.9703	0.0297	1.0	0.4558	-0.0262	0.4296	0.3383	0.0013	0.3396
8	0.10000	0.9703	0.0297	1.0	0.2667	-0.0282	0.2385	0.2072	0.0017	0.2089
9	0.04650	0.9724	0.0276	1.0	0.1468	-0.0268	0.1200	0.1481	0.0019	0.1500
10	0.02150	0.9719	0.0281	1.0	0.0877	-0.0277	0.0600	0.0789	0.0011	0.0800
11	0.01000	0.9716	0.0284	1.0	0.0581	-0.0281	0.0300	0.0394	0.0006	0.0400
12	0.00465	0.9715	0.0285	1.0	0.0500	-0.0281	0.0219	0.0004	-0.0004	0.0000

			Г3 ИЗ I Б I+К			B4 ИЗ I Б I+К			B5 ИЗ I Б I+К		
			B0			B0			B0		
II	Б МЭВ	ПРИ К РАВНОМ		I B5	ПРИ К РАВНОМ		I B4	ПРИ К РАВНОМ		I B5
I	I	0	1	I B0	0	1	I B0	0	1	I B0
1	6.50000	3.1750	-0.0036	3.1714	3.3578	0.0201	3.3774	2.9546	0.1138	3.0684
2	4.00000	2.3019	-0.0280	2.0809	2.4219	0.0385	2.4604	1.9845	0.0188	2.0033
3	2.50000	1.1030	-0.0316	1.0714	1.3883	0.0249	1.4132	0.7860	-0.0043	0.7817
4	1.40000	0.5493	-0.0184	0.5309	0.5598	-0.0004	0.5594	0.2200	-0.0017	0.2183
5	0.80000	0.2322	-0.0179	0.2143	0.1339	-0.0001	0.1338	0.0703	0.0000	0.0703
6	0.40000	0.1110	-0.0087	0.1023	0.0514	-0.0002	0.0512	0.0502	0.0003	0.0505
7	0.20000	0.0241	-0.0047	0.0194	0.0152	0.0000	0.0152	0.0050	-0.0001	0.0049
8	0.10000	0.0113	-0.0031	0.0082	0.0019	-0.0001	0.0018	0.0000	0.0000	0.0000
9	0.04650	0.0064	-0.0024	0.0040	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.02150	0.0033	-0.0013	0.0020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11	0.01000	0.0016	-0.0006	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.00465	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Niobium

			B0 из I в I+K			B1 из I в I+K			B2 из I в I+K		
			B0			B0			B0		
II	E МэВ	I	При к равном:		B01	При к равном		B1	При к равном		B2
			0	1	B01	0	1	B0	0	1	B0
1	6.50000		0.9630	0.0370	1.0	2.2249	-0.0069	2.2100	2.9789	0.0116	2.99051
2	4.00000		0.9672	0.0328	1.0	1.7838	-0.0065	1.7773	2.1518	0.0118	2.16361
3	2.50000		0.9774	0.0226	1.0	1.8026	0.0034	1.8060	2.0578	0.0150	2.07281
4	1.40000		0.9779	0.0221	1.0	1.6716	0.0035	1.6751	1.5804	0.0004	1.58081
5	0.80000		0.9654	0.0346	1.0	1.2428	-0.0124	1.2304	0.8541	-0.0050	0.84911
6	0.40000		0.9741	0.0259	1.0	0.8682	-0.0148	0.8534	0.4731	-0.0043	0.46881
7	0.20000		0.9727	0.0273	1.0	0.5417	-0.0217	0.5200	0.2407	-0.0025	0.23821
8	0.10000		0.9705	0.0295	1.0	0.2885	-0.0269	0.2616	0.1317	-0.0007	0.13101
9	0.04650		0.9732	0.0268	1.0	0.1647	-0.0247	0.1400	0.0706	-0.0000	0.07061
10	0.02150		0.9726	0.0274	1.0	0.1060	-0.0260	0.0800	0.0306	-0.0006	0.03001
11	0.01000		0.9724	0.0276	1.0	0.0767	-0.0267	0.0500	0.0155	-0.0005	0.01501
12	0.00465		0.9721	0.0279	1.0	0.0490	-0.0275	0.0215	0.0005	-0.0004	0.00011

			B3 из I в I+K			B4 из I в I+K			B5 из I в I+K		
			B0			B0			B0		
II	E МэВ	I	При к равном		B3	При к равном		B4	При к равном		B5
			0	1	B0	0	1	B0	0	1	B0
1	6.50000		3.1913	-0.0135	3.1778	3.2487	0.0195	3.2682	2.8569	0.0987	2.95561
2	4.00000		2.1255	-0.0257	2.0998	2.2789	0.0361	2.3150	1.6910	-0.0050	1.68601
3	2.50000		1.4137	-0.0322	1.3815	1.4205	0.0182	1.4387	0.5669	-0.0143	0.55261
4	1.40000		0.7531	-0.0208	0.7323	0.6487	0.0000	0.6487	0.2297	-0.0016	0.22811
5	0.80000		0.2243	-0.0147	0.2096	0.1102	-0.0021	0.1081	0.0574	0.0006	0.05801
6	0.40000		0.0564	-0.0068	0.0526	0.0491	-0.0003	0.0488	0.0202	0.0005	0.02071
7	0.20000		0.0031	-0.0031	0.0000	0.0000	0.0000	0.0000	0.0058	0.0000	0.00581
8	0.10000		0.0019	-0.0019	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00001
9	0.04650		0.0012	-0.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00001
10	0.02150		0.0005	-0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00001
11	0.01000		0.0003	-0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00001
12	0.00465		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

			B0 ИЗ I Б I+К			E1 ИЗ I В I+К			B2 ИЗ I Е I+К		
			Б0			Б0			Б0		
II	I	E МЭВ	ПРИ К РАВНОМ		B0I	ПРИ К РАВНОМ		B1	ПРИ К РАВНОМ		B2
I	I		0	1	Б0I	0	1	Б0	0	1	Б0
1	1	6.50000	0.9851	0.0349	1.0	1.9625	-0.0073	1.9552	2.5445	0.0047	2.5492
2	2	4.00000	0.9831	0.0369	1.0	1.6323	-0.0155	1.6168	1.9756	0.0106	1.9862
3	3	2.50000	0.9877	0.0323	1.0	1.4595	-0.0136	1.4459	1.6510	0.0156	1.6666
4	4	1.40000	0.9774	0.0226	1.0	1.4659	-0.0032	1.4627	1.4723	0.0052	1.4775
5	5	0.80000	0.9727	0.0273	1.0	1.2838	-0.0084	1.2754	1.0224	-0.0005	1.0219
6	6	0.40000	0.9757	0.0243	1.0	0.9582	-0.0146	0.9436	0.6627	0.0010	0.6637
7	7	0.20000	0.9741	0.0259	1.0	0.6050	-0.0216	0.5834	0.4646	0.0021	0.4667
8	8	0.10000	0.9720	0.0280	1.0	0.3462	-0.0258	0.3204	0.2816	0.0019	0.2837
9	9	0.04650	0.9745	0.0255	1.0	0.2136	-0.0236	0.1900	0.1689	0.0011	0.1700
10	10	0.02150	0.9740	0.0260	1.0	0.1543	-0.0243	0.1300	0.0802	-0.0002	0.0800
11	11	0.01000	0.9734	0.0266	1.0	0.0955	-0.0255	0.0700	0.0402	-0.0002	0.0400
12	12	0.00465	0.9730	0.0270	1.0	0.0475	-0.0266	0.0209	0.0005	-0.0004	0.0001

			B3 ИЗ I Е I+К			B4 ИЗ I В I+К			B5 ИЗ I Б I+К		
			B0			B0			B0		
II	I	E МЭВ	ПРИ К РАВНОМ		B3	ПРИ К РАВНОМ		B4	ПРИ К РАВНОМ		B5
I	I		0	1	Б0	0	1	Б0	0	1	Б0
1	1	6.50000	2.7627	-0.0090	2.7537	2.8229	0.0309	2.8538	2.2603	0.0561	2.3164
2	2	4.00000	1.9242	-0.0299	1.8943	2.2075	0.0428	2.2503	1.4341	-0.0087	1.4254
3	3	2.50000	1.1043	-0.0334	1.0709	1.3789	0.0286	1.4075	0.5177	-0.0151	0.5026
4	4	1.40000	0.7122	-0.0172	0.6950	0.6146	-0.0005	0.6141	0.1634	-0.0053	0.1581
5	5	0.80000	0.3340	-0.0146	0.3194	0.1360	-0.0025	0.1335	0.0255	-0.0008	0.0247
6	6	0.40000	0.1129	-0.0099	0.1030	0.0296	-0.0005	0.0291	0.0008	-0.0002	0.0006
7	7	0.20000	0.0397	-0.0061	0.0336	0.0094	-0.0001	0.0093	0.0000	0.0000	0.0000
8	8	0.10000	0.0162	-0.0039	0.0123	0.0026	-0.0001	0.0025	0.0000	0.0000	0.0000
9	9	0.04650	0.0086	-0.0026	0.0060	0.0040	0.0000	0.0040	0.0000	0.0000	0.0000
10	10	0.02150	0.0042	-0.0012	0.0030	0.0020	0.0000	0.0020	0.0000	0.0000	0.0000
11	11	0.01000	0.0026	-0.0006	0.0020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	12	0.00465	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

			B0 ИЗ I Б I+K			B1 ИЗ I Б I+K			B2 ИЗ I Б I+K		
			B0			B0			B0		
II	E МЭВ	ПРИ К РАВНОМ		B0	ПРИ К РАВНОМ		B1	ПРИ К РАВНОМ		B2
		0	1	B0	0	1	B0	0	1	B0
1	6.50000	0.9716	0.0284	1.0	2.0884	-0.0023	2.0861	2.6788	-0.0016	2.6772
2	4.00000	0.9740	0.0260	1.0	1.7995	-0.0078	1.7917	2.2672	0.0132	2.2804
3	2.50000	0.9785	0.0215	1.0	1.7165	-0.0021	1.7144	1.9904	0.0178	2.0082
4	1.40000	0.9799	0.0201	1.0	1.4587	-0.0081	1.4506	1.5847	0.0105	1.5952
5	0.80000	0.9810	0.0190	1.0	1.2730	-0.0052	1.2678	1.1499	0.0027	1.1526
6	0.40000	0.9852	0.0148	1.0	1.1918	-0.0026	1.1892	0.7900	-0.0041	0.7859
7	0.20000	0.9823	0.0177	1.0	0.9758	-0.0083	0.9675	0.4672	-0.0050	0.4622
8	0.10000	0.9795	0.0205	1.0	0.5653	-0.0167	0.5486	0.2467	-0.0016	0.2451
9	0.04650	0.9789	0.0211	1.0	0.2570	-0.0170	0.2400	0.1216	-0.0016	0.1200
10	0.02150	0.9783	0.0217	1.0	0.1400	-0.0200	0.1200	0.0515	-0.0015	0.0500
11	0.01000	0.9782	0.0218	1.0	0.0800	-0.0200	0.0600	0.0210	-0.0010	0.0200
12	0.00465	0.9782	0.0218	1.0	0.0384	-0.0216	0.0168	0.0003	-0.0002	0.0001

			B3 ИЗ I Б I+K			B4 ИЗ I Б I+K			B5 ИЗ I Б I+K		
			B0			B0			B0		
II	E МЭВ	ПРИ К РАВНОМ		B3	ПРИ К РАВНОМ		B4	ПРИ К РАВНОМ		B5
		0	1	B0	0	1	B0	0	1	B0
1	6.50000	2.9802	-0.0038	2.9824	3.2555	-0.0041	3.2514	3.3500	0.1203	3.4703
2	4.00000	2.2263	-0.0059	2.2204	2.0498	-0.0129	2.0369	2.0598	0.0341	2.0939
3	2.50000	1.3237	-0.0186	1.3051	0.8319	-0.0083	0.8236	0.5036	-0.0032	0.5004
4	1.40000	0.6829	-0.0175	0.6654	0.3457	-0.0007	0.3450	0.1001	-0.0029	0.0972
5	0.80000	0.2938	-0.0145	0.2793	0.1669	-0.0003	0.1666	0.0330	-0.0011	0.0319
6	0.40000	0.1228	-0.0076	0.1152	0.0591	-0.0001	0.0590	0.0118	-0.0003	0.0115
7	0.20000	0.0527	-0.0041	0.0486	0.0245	0.0000	0.0245	0.0045	-0.0001	0.0044
8	0.10000	0.0258	-0.0020	0.0238	0.0112	0.0000	0.0112	0.0011	-0.0001	0.0010
9	0.04650	0.0000	0.0000	0.0000	0.0050	0.0000	0.0050	0.0000	0.0000	0.0000
10	0.02150	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11	0.01000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.00465	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

№	E эВ	B0 из I с I+к при к равном 0	B0 из I с I+к при к равном 1	B0 из I с I+к B0	B1 из I с I+к при к равном 0	B1 из I с I+к при к равном 1	B1 из I с I+к B0	B2 из I в I+к при к равном 0	B2 из I в I+к при к равном 1	B2 из I в I+к B0
1	6.50000	0.9833	0.0167	1.0	2.1826	-0.0019	2.1807	2.9631	0.0087	2.9718
2	4.20000	0.9881	0.0119	1.0	2.1807	0.0044	2.1851	2.8431	0.0009	2.8440
3	2.50000	0.9908	0.0092	1.0	2.1047	0.0029	2.1076	2.4749	-0.0013	2.4736
4	1.40000	0.9926	0.0074	1.0	2.0076	0.0001	2.0077	2.3239	0.0009	2.3248
5	0.80000	0.9872	0.0128	1.0	1.4918	-0.0047	1.4871	1.5198	0.0014	1.5212
6	0.40000	0.9867	0.0133	1.0	0.9458	-0.0085	0.9373	0.7707	0.0000	0.7707
7	0.20000	0.9850	0.0150	1.0	0.5447	-0.0118	0.5329	0.3185	-0.0013	0.3172
8	0.10000	0.9843	0.0157	1.0	0.2840	-0.0140	0.2700	0.1218	-0.0009	0.1209
9	0.04650	0.9861	0.0139	1.0	0.1429	-0.0129	0.1300	0.0604	-0.0004	0.0600
10	0.02150	0.9858	0.0142	1.0	0.0737	-0.0137	0.0600	0.0203	-0.0003	0.0200
11	0.01000	0.9856	0.0144	1.0	0.0440	-0.0140	0.0300	0.0102	-0.0002	0.0100
12	0.00465	0.9856	0.0144	1.0	0.0253	-0.0143	0.0110	0.0001	-0.0001	0.0000

№	E эВ	B3 из I с I+к при к равном 0	B3 из I с I+к при к равном 1	B3 из I с I+к B0	B4 из I с I+к при к равном 0	B4 из I с I+к при к равном 1	B4 из I с I+к B0	B5 из I с I+к при к равном 0	B5 из I с I+к при к равном 1	B5 из I с I+к B0
1	6.50000	3.3544	0.0038	3.3582	3.4420	0.0088	3.4508	3.2432	0.0675	3.3107
2	4.20000	3.0483	0.0041	3.0524	2.9156	0.0063	2.9219	2.2170	0.0109	2.2279
3	2.50000	2.5708	0.0099	2.5807	1.9239	-0.0039	1.9200	1.3330	-0.0050	1.3280
4	1.40000	2.3207	0.0050	2.3257	1.2256	-0.0067	1.2189	0.3535	-0.0048	0.3487
5	0.80000	1.0599	-0.0044	1.0548	0.4079	-0.0031	0.4048	0.0849	-0.0013	0.0836
6	0.40000	0.2611	-0.0039	0.2572	0.0722	-0.0006	0.0716	0.0165	-0.0001	0.0162
7	0.20000	0.0456	-0.0016	0.0440	0.0069	-0.0001	0.0068	0.0000	0.0000	0.0000
8	0.10000	0.0102	-0.0006	0.0096	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
9	0.04650	0.0054	-0.0004	0.0050	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.02150	0.0031	-0.0001	0.0030	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11	0.01000	0.0011	-0.0001	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.00465	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

	B0 из I в I+K			B1 из I в I+K			B2 из I в I+K		
	B0			B0			B0		
II E мэв	при K равном		B0I	при K равном		B1	при K равном		B2
I	0	1	I B0I	0	1	B0	0	1	B0
1 6.50000	0.9830	0.0170	1.0	2.0255	0.0004	2.0257	2.7141	0.0018	2.7159
2 4.00000	0.9906	0.0094	1.0	2.3240	0.0063	2.3303	2.9928	0.0019	2.9947
3 2.50000	0.9903	0.0097	1.0	2.1156	0.0006	2.1162	2.6129	0.0004	2.6133
4 1.40000	0.9935	0.0065	1.0	1.8743	0.0002	1.8745	2.2406	0.0021	2.2427
5 0.80000	0.9879	0.0121	1.0	1.5903	-0.0047	1.5856	1.6890	0.0033	1.6923
6 0.40000	0.9863	0.0137	1.0	0.9448	-0.0097	0.9351	0.8776	0.0006	0.8782
7 0.20000	0.9843	0.0157	1.0	0.4512	-0.0133	0.4379	0.2690	-0.0015	0.2675
8 0.10000	0.9837	0.0163	1.0	0.1887	-0.0152	0.1735	0.0559	-0.0009	0.0550
9 0.04650	0.9858	0.0142	1.0	0.0835	-0.0135	0.0700	0.0195	-0.0005	0.0190
10 0.02150	0.9856	0.0144	1.0	0.0440	-0.0140	0.0300	0.0052	-0.0002	0.0050
11 0.01000	0.9856	0.0144	1.0	0.0341	-0.0141	0.0200	0.0002	-0.0002	0.0000
12 0.00465	0.9859	0.0141	1.0	0.0249	-0.0140	0.0109	0.0001	-0.0001	0.0000

	B3 из I в I+K			B4 из I в I+K			B5 из I в I+K		
	B0			B0			B0		
II E мэв	при K равном		B3	при K равном		B4	при K равном		B5
I	0	1	B0	0	1	B0	0	1	B0
1 6.50000	3.0837	0.0031	3.0868	3.3723	0.0098	3.3821	3.1228	0.0706	3.1935
2 4.00000	3.2870	0.0080	3.2950	2.9899	0.0017	2.9916	2.4569	0.0134	2.4703
3 2.50000	2.6770	0.0103	2.6873	1.9799	-0.0039	1.9760	1.6077	-0.0058	1.6019
4 1.40000	2.1556	0.0019	2.1575	1.2756	-0.0064	1.2692	0.9397	-0.0037	0.9360
5 0.80000	1.1499	-0.0043	1.1456	0.4486	-0.0045	0.4441	0.1433	-0.0007	0.1426
6 0.40000	0.3428	-0.0035	0.3393	0.1111	-0.0007	0.1104	0.0751	-0.0002	0.0749
7 0.20000	0.0703	-0.0007	0.0696	0.0226	-0.0001	0.0225	0.0075	0.0000	0.0075
8 0.10000	0.0113	-0.0002	0.0113	0.0040	0.0000	0.0040	0.0017	0.0000	0.0017
9 0.04650	0.0041	-0.0001	0.0040	0.0020	0.0000	0.0020	0.0010	0.0000	0.0010
10 0.02150	0.0030	0.0000	0.0030	0.0010	0.0000	0.0010	0.0000	0.0000	0.0000
11 0.01000	0.0020	0.0000	0.0020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12 0.00465	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Lead

		B0 ИЗ I Б I+К			B1 ИЗ I Б I+К			B2 ИЗ I Б I+К		
		B0			B0			B0		
II	E МЭВ	ПРИ К РАВНОМ		B0	ПРИ К РАВНОМ		B1	ПРИ К РАВНОМ		B2
		0	1	B0	0	1	B0	0	1	B0
1	6.50000	0.9812	0.0188	1.0	2.1409	-0.0057	2.1352	2.9894	0.0016	2.9910
2	4.00000	0.9649	0.0151	1.0	1.9006	-0.0071	1.8935	2.6034	0.0029	2.6063
3	2.50000	0.9857	0.0143	1.0	1.4800	-0.0079	1.4721	1.8734	-0.0012	1.8722
4	1.40000	0.9890	0.0110	1.0	1.1223	-0.0082	1.1141	1.2268	-0.0034	1.2234
5	0.80000	0.9838	0.0162	1.0	0.6958	-0.0161	0.6797	0.8026	0.0041	0.8067
6	0.40000	0.9871	0.0129	1.0	0.4444	-0.0107	0.4337	0.5738	0.0021	0.5759
7	0.20000	0.9854	0.0146	1.0	0.4669	-0.0115	0.4554	0.3307	-0.0018	0.3289
8	0.10000	0.9858	0.0142	1.0	0.2810	-0.0125	0.2685	0.0869	-0.0013	0.0856
9	0.04650	0.9874	0.0126	1.0	0.1609	-0.0109	0.1500	0.0310	-0.0010	0.0300
10	0.02150	0.9875	0.0125	1.0	0.0196	-0.0126	0.0070	0.0100	0.0000	0.0100
11	0.01000	0.9874	0.0126	1.0	0.0166	-0.0126	0.0040	0.0050	0.0000	0.0050
12	0.00465	0.9874	0.0126	1.0	0.0222	-0.0125	0.0097	0.0001	-0.0001	0.0000

		B3 ИЗ I Б I+К			B4 ИЗ I Б I+К			B5 ИЗ I Б I+К		
		B0			B0			B0		
II	E МЭВ	ПРИ К РАВНОМ		B3	ПРИ К РАВНОМ		B4	ПРИ К РАВНОМ		B5
		0	1	B0	0	1	B0	0	1	B0
1	6.50000	3.6556	0.0135	3.6691	3.8466	-0.0022	3.8444	3.7321	0.0861	3.8182
2	4.00000	2.8610	0.0001	2.8611	2.7922	0.0134	2.8056	2.0712	0.0017	2.0729
3	2.50000	1.9320	0.0056	1.9376	1.6340	0.0016	1.6356	0.7172	-0.0070	0.7102
4	1.40000	1.6906	0.0093	1.6999	0.9144	-0.0035	0.9109	0.1512	-0.0045	0.1467
5	0.80000	1.0068	0.0000	1.0068	0.4477	-0.0012	0.4465	0.0822	-0.0026	0.0796
6	0.40000	0.3623	-0.0027	0.3596	0.1396	-0.0006	0.1390	0.0376	-0.0006	0.0370
7	0.20000	0.0804	-0.0011	0.0793	0.0461	0.0000	0.0461	0.0448	0.0001	0.0449
8	0.10000	0.0170	-0.0004	0.0166	0.0252	0.0003	0.0255	0.0048	-0.0002	0.0046
9	0.04650	0.0083	-0.0003	0.0080	0.0238	0.0002	0.0240	0.0002	-0.0002	0.0000
10	0.02150	0.0041	-0.0001	0.0040	0.0119	0.0001	0.0120	0.0001	-0.0001	0.0000
11	0.01000	0.0020	0.0000	0.0020	0.0050	0.0000	0.0050	0.0000	0.0000	0.0000
12	0.00465	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

	B0 ИЗ I В I*К			B1 ИЗ I В I*К			B2 ИЗ I В I*К		
	B0			B0			B0		
II I E МЭВ	ПРИ К РАВНОМ		B01	ПРИ К РАВНОМ		B1	ПРИ К РАВНОМ		L2
I I	0	1	B0I	0	1	B0	0	1	L0
I 1 6.50000	0.9977	0.0123	1.0	2.2934	0.0024	2.2958	3.1910	0.0035	3.1945I
I 2 4.00000	0.9865	0.0135	1.0	2.1204	-0.0010	2.1194	2.8378	0.0032	2.8410I
I 3 2.50000	0.9859	0.0141	1.0	1.4534	-0.0100	1.4434	1.8907	0.0027	1.8934I
I 4 1.40000	0.9889	0.0111	1.0	1.0328	-0.0085	1.0243	1.2703	-0.0042	1.2658I
I 5 0.80000	0.9842	0.0158	1.0	0.6438	-0.0125	0.6313	0.8036	-0.0023	0.8013I
I 6 0.40000	0.9856	0.0144	1.0	0.4343	-0.0123	0.4220	0.4193	-0.0004	0.4189I
I 7 0.20000	0.9358	0.0142	1.0	0.3129	-0.0121	0.3008	0.1678	-0.0014	0.1664I
I 8 0.10000	0.9863	0.0137	1.0	0.2231	-0.0121	0.2110	0.0496	-0.0015	0.0481I
I 9 0.04650	0.9881	0.0119	1.0	0.1668	-0.0108	0.1560	0.0092	-0.0012	0.0080I
I10 0.02150	0.9879	0.0121	1.0	0.1114	-0.0114	0.1000	0.0009	-0.0009	0.0000I
I11 0.01000	0.9870	0.0122	1.0	0.0719	-0.0119	0.0600	0.0005	-0.0005	0.0000I
I12 0.00465	0.9875	0.0125	1.0	0.0219	-0.0124	0.0095	0.0001	-0.0001	0.0000I

	[illegible]			B4 ИЗ I В I*К			B5 ИЗ I В I*К		
	B0			B0			B0		
II I E [illegible]	[illegible]		B3	ПРИ К РАВНОМ		B4	ПРИ К РАВНОМ		B5
I I	0	1	B0	0	1	B0	0	1	B0
I 1 6.50000	3.7074	0.0029	3.7101	4.0229	0.0153	4.0382	3.7251	0.0752	3.8003I
I 2 4.00000	3.1166	0.0046	3.1212	3.0206	0.0020	3.0226	2.4755	0.0166	2.4921I
I 3 2.50000	1.9414	-0.0005	1.9409	1.7706	-0.0070	1.7636	0.9361	-0.0077	0.9284I
I 4 1.40000	1.6062	0.0096	1.6158	1.1744	-0.0035	1.1709	0.2770	-0.0036	0.2734I
I 5 0.80000	0.9825	0.0046	0.9884	0.5541	-0.0033	0.5508	0.0468	-0.0014	0.0454I
I 6 0.40000	0.5165	-0.0005	0.5160	0.0986	-0.0011	0.0977	0.0071	0.0001	0.0072I
I 7 0.20000	0.0543	-0.0005	0.0538	0.0052	-0.0002	0.0050	0.0001	0.0001	0.0001I
I 8 0.10000	0.0101	-0.0001	0.0100	0.0000	0.0000	0.0000	0.0004	0.0000	0.0004I
I 9 0.04650	0.0021	0.0000	0.0021	0.0000	0.0000	0.0000	0.0001	0.0000	0.0001I
I10 0.02150	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000I
I11 0.01000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000I
I12 0.00465	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000I

II	E (эВ)	ПРИ К РАВНОМ 0	ПРИ К РАВНОМ 1	B0	ПРИ К РАВНОМ 0	ПРИ К РАВНОМ 1	B1	B2 ИЗ I P I-K ПРИ К РАВНОМ 0	ПРИ К РАВНОМ 1	B2
1	6.50000	0.9970	0.0122	1.0	2.3956	-0.0011	2.3957	3.3567	0.0074	3.3641
2	4.00000	0.9922	0.0078	1.0	2.2614	0.0011	2.2525	3.1980	0.0040	3.2020
3	2.50000	0.9920	0.0074	1.0	2.0615	-0.0015	2.0500	2.7022	0.0006	2.7038
4	1.40000	0.9920	0.0072	1.0	1.7416	-0.0016	1.7400	1.9845	-0.0033	1.9812
5	0.80000	0.9890	0.0102	1.0	1.3150	-0.0032	1.3100	1.2223	-0.0020	1.2203
6	0.40000	0.9891	0.0109	1.0	1.0355	-0.0053	1.0282	0.7120	-0.0021	0.7099
7	0.20000	0.9880	0.0120	1.0	0.8331	-0.0084	0.8247	0.2967	-0.0023	0.2944
8	0.10000	0.9880	0.0120	1.0	0.6814	-0.0097	0.6717	0.1093	-0.0019	0.1074
9	0.04650	0.9890	0.0110	1.0	0.2684	-0.0084	0.2600	0.0414	-0.0014	0.0400
10	0.02150	0.9889	0.0111	1.0	0.1595	-0.0095	0.1500	0.0110	-0.0010	0.0100
11	0.01000	0.9885	0.0115	1.0	0.0902	-0.0102	0.0800	0.0055	-0.0005	0.0050
12	0.00465	0.9885	0.0115	1.0	0.0199	-0.0112	0.0086	0.0001	-0.0001	0.0000

II	E (эВ)	ПРИ К РАВНОМ 0	ПРИ К РАВНОМ 1	B3	ПРИ К РАВНОМ 0	ПРИ К РАВНОМ 1	B4	ПРИ К РАВНОМ 0	ПРИ К РАВНОМ 1	B5
1	6.50000	4.0364	-0.0011	4.0353	4.6191	0.0166	4.6357	4.3737	0.0337	4.4074
2	4.00000	3.5121	0.0001	3.5123	3.6374	0.0059	3.6432	3.1127	0.0273	3.1400
3	2.50000	2.9301	0.0004	2.9304	2.9292	0.0063	2.9355	2.2289	0.0077	2.2366
4	1.40000	2.3337	0.0048	2.3385	2.0380	-0.0005	2.0375	1.1975	-0.0031	1.1944
5	0.80000	1.1701	-0.0002	1.1779	0.6241	-0.0023	0.6218	0.1837	-0.0017	0.1820
6	0.40000	0.3744	-0.0023	0.3721	0.1217	-0.0010	0.1207	0.0337	0.0001	0.0338
7	0.20000	0.0661	-0.0011	0.0654	0.0046	-0.0003	0.0043	0.0117	0.0001	0.0118
8	0.10000	0.0211	-0.0003	0.0209	0.0001	-0.0001	0.0000	0.0059	0.0001	0.0060
9	0.04650	0.0101	-0.0002	0.0100	0.0000	0.0000	0.0000	0.0030	0.0000	0.0030
10	0.02150	0.0010	0.0000	0.0050	0.0000	0.0000	0.0000	0.0010	0.0000	0.0010
11	0.01000	0.0020	0.0000	0.0020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.00465	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

	B0 F2 I B I*K			B1 F3 I B I*K			B2 F3 I B I*K		
	BC			BC			BC		
II E ДОВ	ПРИ I РАВНО		B0	ПРИ К РАВНОМ		B1	ПРИ К РАВНОМ		B2
	0	1	B0	0	1	B0	0	1	B0
1 6.50000	0.9925	0.0075	1.0	2.4066	0.0009	2.4075	3.5420	0.0103	3.5523
2 4.00000	0.9934	0.0066	1.0	2.4545	0.0031	2.4576	3.4752	0.0019	3.4771
3 2.50000	0.9926	0.0074	1.0	2.1211	0.0014	2.1225	2.6001	-0.0050	2.5951
4 1.40000	0.9921	0.0079	1.0	1.6077	-0.0009	1.6068	1.7165	-0.0065	1.7095
5 0.60000	0.9902	0.0098	1.0	1.3910	-0.0024	1.3886	1.2460	-0.0023	1.2437
6 0.40000	0.9900	0.0100	1.0	1.0969	-0.0040	1.0829	0.7402	-0.0025	0.7377
7 0.20000	0.9880	0.0119	1.0	0.7179	-0.0075	0.7104	0.3454	-0.0023	0.3431
8 0.10000	0.9884	0.0116	1.0	0.4137	-0.0094	0.4042	0.1421	-0.0017	0.1404
9 0.04000	0.9902	0.0098	1.0	0.2386	-0.0086	0.2300	0.0611	-0.0011	0.0600
10 0.02150	0.9900	0.0110	1.0	0.1299	-0.0099	0.1200	0.0306	-0.0006	0.0300
11 0.01000	0.9889	0.0111	1.0	0.0408	-0.0106	0.0300	0.0101	-0.0001	0.0100
12 0.00465	0.9889	0.0111	1.0	0.0195	-0.0110	0.0085	0.0001	-0.0001	0.0000

	B3 F3 I B I*I			B4 F3 I B I*I			B5 F3 I B I*K		
	BC			BC			BC		
II E ДОВ	ПРИ I РАВНО		B3	ПРИ К РАВНОМ		B4	ПРИ К РАВНОМ		B5
	0	1	B0	0	1	B0	0	1	B0
1 6.50000	4.2130	0.0022	4.2160	4.6234	0.0067	4.6301	4.4697	0.0898	4.5595
2 4.00000	3.8766	0.0055	3.8823	3.9265	-0.0035	3.9230	3.6697	0.0373	3.6470
3 2.50000	3.0159	0.0049	3.0238	2.7665	0.0023	2.7688	2.3740	0.0110	2.3850
4 1.40000	2.0955	0.0089	2.1047	1.8645	-0.0024	1.8645	1.1712	-0.0021	1.1691
5 0.60000	1.3509	0.0093	1.3602	0.6756	-0.0023	0.6733	0.1642	-0.0028	0.1614
6 0.40000	0.9098	-0.0024	0.9074	0.1429	-0.0005	0.1424	0.0190	-0.0005	0.0185
7 0.20000	0.3960	-0.0012	0.0954	0.0402	0.0000	0.0402	0.0001	-0.0002	0.0000
8 0.10000	0.0330	-0.0004	0.0332	0.0166	0.0000	0.0166	0.0001	-0.0001	0.0000
9 0.04000	0.0153	-0.0003	0.0150	0.0070	0.0000	0.0070	0.0000	0.0000	0.0000
10 0.02150	0.0076	-0.0002	0.0074	0.0030	0.0000	0.0030	0.0000	0.0000	0.0000
11 0.01000	0.0011	-0.0001	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12 0.00465	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

	B0 ИЗ I В I+К			B1 ИЗ I В I+К			B2 ИЗ I В I+К		
	B0			B0			B0		
I II E МЭВ	ПРИ К РАВНОМ		B0	ПРИ К РАВНОМ		B1	ПРИ К РАВНОМ		B2
	0	1	B0	0	1	B0	0	1	B0
1 6.50000	0.9907	0.0093	1.0	2.4085	0.0060	2.4145	3.2451	0.0030	3.2481
2 4.00000	0.9924	0.0076	1.0	2.2646	0.0004	2.2650	3.0891	0.0035	3.0926
3 2.50000	0.9933	0.0067	1.0	2.1622	-0.0008	2.1614	2.8480	0.0030	2.8510
4 1.40000	0.9925	0.0075	1.0	1.5643	-0.0019	1.5624	1.7204	-0.0027	1.7177
5 0.80000	0.9902	0.0098	1.0	1.3430	-0.0029	1.3401	1.2026	-0.0012	1.2014
6 0.40000	0.9898	0.0102	1.0	1.0324	-0.0051	1.0273	0.7565	-0.0014	0.7551
7 0.20000	0.9885	0.0115	1.0	0.6545	-0.0081	0.6464	0.3324	-0.0017	0.3307
8 0.10000	0.9882	0.0118	1.0	0.3580	-0.0099	0.3481	0.1151	-0.0013	0.1138
9 0.04650	0.9893	0.0107	1.0	0.1794	-0.0094	0.1700	0.0408	-0.0008	0.0400
10 0.02150	0.9890	0.0110	1.0	0.0804	-0.0104	0.0700	0.0153	-0.0003	0.0150
11 0.01000	0.9888	0.0112	1.0	0.0406	-0.0108	0.0300	0.0071	-0.0001	0.0070
12 0.00465	0.9891	0.0109	1.0	0.0193	-0.0109	0.0084	0.0001	-0.0001	0.0000

	B3 ИЗ I В I+К			B4 ИЗ I В I+К			B5 ИЗ I В I+К		
	B0			B0			B0		
I II E МЭВ	ПРИ К РАВНОМ		B3	ПРИ К РАВНОМ		B4	ПРИ К РАВНОМ		B5
	0	1	B0	0	1	B0	0	1	B0
1 6.50000	3.8050	0.0055	3.8105	3.8013	0.0057	3.8070	3.5369	0.0046	3.5415
2 4.00000	3.4716	0.0035	3.4751	3.3713	0.0020	3.3733	2.8821	0.0264	2.9085
3 2.50000	3.0193	-0.0020	3.0173	2.8843	0.0056	2.8899	2.2380	0.0045	2.2425
4 1.40000	1.8335	0.0031	1.8366	1.4727	0.0002	1.4729	0.6075	-0.0052	0.6023
5 0.80000	1.0289	-0.0019	1.0270	0.5762	-0.0002	0.5760	0.0201	-0.0039	0.0162
6 0.40000	0.3358	-0.0030	0.3328	0.1571	0.0000	0.1571	-0.0374	-0.0010	-0.0384
7 0.20000	0.2412	-0.0020	0.0392	0.0352	0.0009	0.0361	-0.0419	-0.0009	-0.0428
8 0.10000	-0.0172	-0.0009	-0.0181	0.0309	0.0006	0.0315	-0.0241	-0.0003	-0.0244
9 0.04650	-0.0095	-0.0005	-0.0100	0.0128	0.0002	0.0130	0.0001	-0.0001	0.0000
10 0.02150	-0.0048	-0.0002	-0.0050	0.0049	0.0001	0.0050	0.0000	0.0000	0.0000
11 0.01000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12 0.00465	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

		B0 ИЗ I В I+K			B1 ИЗ I В I+K			B2 ИЗ I В I+K		
		B0			B0			B0		
II	E МЭВ	ПРИ К РАВНОМ		B0	ПРИ К РАВНОМ		B1	ПРИ К РАВНОМ		B2
		0	1	B0	0	1	B0	0	1	B0
1	6.50000	0.9892	0.0108	1.0	2.3303	-0.0002	2.3301	3.3219	0.0045	3.3264
2	4.00000	0.9924	0.0076	1.0	2.2996	0.0019	2.3015	3.1514	0.0018	3.1532
3	2.50000	0.9918	0.0082	1.0	1.9978	-0.0008	1.9970	2.4228	-0.0005	2.4223
4	1.40000	0.9933	0.0067	1.0	1.6574	-0.0010	1.6564	1.8095	-0.0037	1.8058
5	0.80000	0.9902	0.0098	1.0	1.3801	-0.0029	1.3772	1.2696	-0.0025	1.2671
6	0.40000	0.9904	0.0096	1.0	1.0619	-0.0036	1.0583	0.7024	-0.0038	0.6986
7	0.20000	0.9889	0.0111	1.0	0.6948	-0.0071	0.6877	0.2101	-0.0033	0.2068
8	0.10000	0.9881	0.0119	1.0	0.3641	-0.0098	0.3543	0.0870	-0.0018	0.0852
9	0.04650	0.9894	0.0106	1.0	0.1892	-0.0092	0.1800	0.0261	-0.0011	0.0250
10	0.02150	0.9890	0.0110	1.0	0.0902	-0.0102	0.0800	0.0105	-0.0005	0.0100
11	0.01000	0.9888	0.0112	1.0	0.0507	-0.0107	0.0400	0.0052	-0.0002	0.0050
12	0.00465	0.9891	0.0109	1.0	0.0192	-0.0108	0.0084	0.0001	-0.0001	0.0000

		B3 ИЗ I В I+K			B4 ИЗ I В I+K			B5 ИЗ I В I+K		
		B0			B0			B0		
II	E МЭВ	ПРИ К РАВНОМ		B3	ПРИ К РАВНОМ		B4	ПРИ К РАВНОМ		B5
		0	1	B0	0	1	B0	0	1	B0
1	6.50000	4.0377	0.0051	4.0428	4.3732	0.0110	4.3842	4.1264	0.0732	4.1996
2	4.00000	3.5216	-0.0007	3.5209	3.5964	0.0086	3.6050	3.0145	0.0200	3.0345
3	2.50000	2.5374	-0.0031	2.5343	2.6765	0.0122	2.6887	1.6961	-0.0035	1.6926
4	1.40000	2.0420	0.0049	2.0469	1.6773	-0.0007	1.6766	0.7310	-0.0036	0.7274
5	0.80000	1.2673	0.0012	1.2685	0.6586	-0.0031	0.6555	0.1721	-0.0018	0.1703
6	0.40000	0.4196	-0.0011	0.4185	0.1378	-0.0007	0.1371	0.0262	-0.0003	0.0259
7	0.20000	0.0942	-0.0004	0.0938	0.0253	-0.0002	0.0251	0.0007	-0.0001	0.0006
8	0.10000	0.0277	-0.0001	0.0276	0.0052	-0.0001	0.0051	0.0000	0.0000	0.0000
9	0.04650	0.0130	0.0000	0.0130	0.0001	-0.0001	0.0000	0.0000	0.0000	0.0000
10	0.02150	0.0060	0.0000	0.0060	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11	0.01000	0.0030	0.0000	0.0030	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.00465	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Deuterium

I	E M3B	3*MU	B1/B0	B2/B0	B3/B0	B4/B0	B5/B0
1	6.50000	1.385	1.1977	1.2931	0.1933	0.2061	-0.0018
2	4.00000	1.033	1.1687	1.1938	0.6657	0.2510	-0.1171
3	2.50000	0.795	0.8919	0.9915	0.7750	0.2934	-0.1544
4	1.40000	0.875	0.6007	0.5670	0.4411	0.2278	0.1171
5	0.80000	0.700	0.3204	0.1615	0.1469	0.1703	0.0290
6	0.40000	0.750	0.3924	-0.1664	-0.0616	0.0120	0.0149
7	0.20000	0.780	0.6753	-0.1000	-0.0350	0.0000	0.0033
8	0.10000	0.910	0.8951	0.0220	-0.0177	0.0000	0.0000
9	0.04650	0.960	0.9530	0.1100	-0.0120	-0.0015	0.0000
10	0.02150	0.990	0.9720	0.1700	-0.0075	-0.0030	0.0000
11	0.01000	0.995	0.9900	0.2400	-0.0000	-0.0075	0.0000
12	0.00465	0.995	1.0000	0.2597	0.0000	-0.0101	0.0000

Tritium

I		3*MU	B1/B0	B2/B0	B3/B0	B4/B0	B5/B0
1			1.4033	1.6611	0.9651	0.3219	0.0466
2			1.0211	1.4880	0.8663	0.2523	0.0000
3			0.5821	1.2087	0.6868	0.1993	0.0000
4			0.0137	0.3846	0.3992	0.1187	0.0000
5			-0.1605	-0.0999	0.1724	0.0605	0.0000
6			0.1363	-0.0059	0.0834	0.0322	0.0000
7			0.4276	0.0501	0.0285	0.0193	0.0000
8			0.5502	0.0816	0.0000	0.0068	0.0000
9			0.6000	0.0960	0.0000	0.0050	0.0000
10			0.6200	0.1030	0.0000	0.0020	0.0000
11			0.6450	0.1090	0.0000	-0.0004	0.0000
12			0.6666	0.1130	0.0000	-0.0019	0.0000

Helium-3

I	E M3B	3*MU	B1/B0	B2/B0	B3/B0	B4/B0	B5/B0
1	6.50000		1.7133	2.0352	1.2534	0.5827	0.0000
2	4.00000		1.5283	1.9484	1.2900	0.3879	0.0000
3	2.50000		1.2472	1.5808	1.1087	0.3396	0.0000
4	1.40000		0.6495	0.8257	0.5939	0.2251	0.0000
5	0.80000		0.2640	0.2127	0.1576	0.1080	0.0000
6	0.40000		0.3195	0.0895	0.0415	0.0305	0.0000
7	0.20000		0.5001	0.0781	0.0128	0.0093	0.0000
8	0.10000		0.6173	0.0924	0.0071	0.0022	0.0000
9	0.04650		0.6550	0.0940	0.0000	0.0018	0.0000
10	0.02150		0.6666	0.1020	0.0000	0.0005	0.0000
11	0.01000		0.6666	0.1090	0.0000	-0.0010	0.0000
12	0.00465		0.6666	0.1130	0.0000	-0.0019	0.0000

Helium-4

I		3*MU	B1/B0	B2/B0	B3/B0	B4/B0	B5/B0
1			1.4934	1.4217	0.5198	0.0999	0.0000
2			1.5133	1.2996	0.5582	0.1000	0.0000
3			1.3325	1.0390	0.4924	0.0948	0.0000
4			1.1379	0.9810	0.3476	0.0503	0.0000
5			0.4444	0.8657	0.4878	0.1383	0.0000
6			-0.6037	0.1353	0.2786	0.0757	0.0000
7			-0.6115	-0.5026	0.0648	0.0000	0.0000
8			-0.0499	-0.3605	0.0045	0.0000	0.0000
9			0.2700	-0.1900	0.0000	0.0000	0.0000
10			0.4050	-0.0550	0.0000	0.0000	0.0000
11			0.4650	0.0100	0.0000	0.0000	0.0000
12			0.5000	0.0530	0.0000	0.0000	0.0000

Lithium-6

	E (MeV)	3*MU	B1/B0	B2/B0	B3/B0	B4/B0	B5/B0
1	6.50000	1.500	1.9320	2.2784	1.7444	1.1374	0.4384
2	4.00000	1.200	1.5933	1.5122	0.9324	0.4934	0.0472
3	2.50000	0.900	0.5883	0.6909	0.2749	0.0848	0.0011
4	1.40000	0.540	0.6336	0.1596	0.0165	0.0010	0.0002
5	0.60000	0.450	0.7147	0.1749	0.0394	0.0076	0.0000
6	0.40000	0.750	0.6683	0.3461	0.1317	0.0326	0.0000
7	0.20000	0.600	0.2960	0.4724	0.2168	0.0858	0.0000
8	0.10000	0.150	-0.1040	-0.0146	0.0597	0.0327	0.0000
9	0.04650	0.210	-0.0660	-0.0300	0.0150	0.0000	0.0000
10	0.02150	0.270	0.1030	0.0100	0.0100	0.0000	0.0000
11	0.01000	0.330	0.2200	0.0200	0.0030	0.0000	0.0000
12	0.00465	0.330	0.3333	0.0279	0.0000	0.0000	0.0000

Lithium-7

	3*MU	B1/B0	B2/B0	B3/B0	B4/B0	B5/B0
1	1.500	1.6249	1.9820	1.7591	1.1830	0.0000
2	1.200	0.8659	1.2414	0.8796	0.4524	0.0000
3	0.900	0.5443	0.7770	0.2460	0.1430	0.0000
4	0.510	0.3910	0.2985	0.0553	0.0780	0.0000
5	0.180	0.1955	0.0223	0.0000	0.0062	0.0000
6	-0.240	-0.3429	-0.1114	0.0042	0.0025	0.0000
7	0.240	0.2486	0.3495	0.1651	0.0647	0.0000
8	0.750	0.8383	0.2430	0.0768	0.0599	0.0000
9	0.450	0.2700	-0.0440	0.0000	0.0000	0.0000
10	0.300	0.2100	-0.0100	0.0000	0.0000	0.0000
11	0.300	0.2350	0.0050	0.0000	0.0000	0.0000
12	0.300	0.2857	0.0205	0.0000	0.0000	0.0000

Beryllium

	E (MeV)	3*MU	B1/B0	B2/B0	B3/B0	B4/B0	B5/B0
1	6.50000	1.920	1.7857	[illegible]	1.7935	1.0909	[illegible]
2	4.00000	1.560	1.5795	1.7396	1.2112	0.4246	0.1024
3	2.50000	0.840	1.1961	1.7079	1.2020	0.4190	0.1048
4	1.40000	0.690	0.2951	0.6011	0.1816	0.1046	0.0101
5	0.90000	0.690	0.6336	0.2529	0.0911	0.0000	0.0000
6	0.40000	0.360	0.1995	0.1153	-0.0033	0.0000	0.0000
7	0.20000	0.300	0.2675	0.0039	0.0000	0.0000	0.0000
8	0.10000	0.270	0.2563	0.0100	0.0000	0.0000	0.0000
9	0.04650	0.240	0.2340	0.0100	0.0000	0.0000	0.0000
10	0.02150	0.210	0.2280	0.0100	0.0000	0.0000	0.0000
11	0.01000	0.210	0.2200	0.0100	0.0000	0.0000	0.0000
12	0.00465	0.210	0.2722	0.0123	0.0000	0.0000	0.0000

Boron

	3*MU	B1/B0	B2/B0	B3/B0	B4/B0	B5/B0
1	1.530	0.9036	1.0252	1.5160	0.4057	0.1064
2	1.320	0.7674	1.4066	0.8782	0.2151	0.0162
3	0.930	0.9077	[illegible]	0.4207	0.1469	0.0016
4	0.360	0.3907	0.4478	0.2330	0.0042	0.0000
5	0.360	0.3246	0.4221	0.0530	0.0000	0.0000
6	0.600	0.6101	0.1425	0.0000	0.0000	0.0000
7	0.240	0.2394	-0.0422	0.0000	0.0000	0.0000
8	0.240	0.2319	0.0319	0.0000	0.0000	0.0000
9	0.210	0.2150	0.0320	0.0000	0.0000	0.0000
10	0.180	0.1980	0.0230	0.0000	0.0000	0.0000
11	0.180	0.1680	0.0150	0.0000	0.0000	0.0000
12	0.180	0.1618	0.0082	0.0000	0.0000	0.0000

Carbon

	E MOB	3*MU	B1 -- B0	B2 -- B0	B3 -- B0	B4 -- B0	B5 -- B0
1	6.50000	1.050	0.8046	1.2102	1.0210	0.6716	0.0140
2	4.00000	0.540	0.9701	1.2356	0.9319	0.4793	0.0093
3	2.50000	0.240	0.0493	1.2825	0.2111	-0.0723	0.0104
4	1.40000	0.330	0.2606	0.2767	0.0717	0.0226	0.0037
5	0.80000	0.390	0.3968	0.0852	0.0342	0.0000	0.0000
6	0.40000	0.360	0.3573	0.0437	0.0137	0.0000	0.0000
7	0.20000	0.240	0.2917	0.0186	0.0026	0.0000	0.0000
8	0.10000	0.210	0.2362	0.0082	0.0000	0.0000	0.0000
9	0.04650	0.180	0.2050	0.0073	0.0000	0.0000	0.0000
10	0.02150	0.180	0.1800	0.0070	0.0000	0.0000	0.0000
11	0.01000	0.180	0.1720	0.0070	0.0000	0.0000	0.0000
12	0.00465	0.180	0.1667	0.0070	0.0000	0.0000	0.0000

Nitrogen

	3*MU	B1 -- B0	B2 -- B0	B3 -- B0	B4 -- B0	B5 -- B0
1	1.050	0.8884	1.3264	1.4423	1.2292	0.2142
2	0.750	0.7642	1.5282	0.8127	0.3898	0.1366
3	0.630	0.0855	1.3196	0.3592	0.1890	0.0458
4	0.390	0.3627	0.2895	0.0497	-0.0004	0.0000
5	0.180	0.3309	0.1984	0.0369	-0.0118	0.0093
6	0.150	0.2051	0.0000	0.0000	0.0000	0.0000
7	0.150	0.1728	0.0000	0.0000	0.0000	0.0000
8	0.150	0.1561	0.0000	0.0000	0.0000	0.0000
9	0.150	0.1455	0.0050	0.0000	0.0000	0.0000
10	0.150	0.1430	0.0050	0.0000	0.0000	0.0000
11	0.150	0.1430	0.0050	0.0000	0.0000	0.0000
12	0.150	0.1429	0.0051	0.0000	0.0000	0.0000

Oxygen

	E MOB	3*MU	B1 -- B0	B2 -- B0	B3 -- B0	B4 -- B0	B5 -- B0
1	6.50000	1.050	0.6885	0.7366	1.0606	0.8028	0.2499
2	4.00000	0.780	0.8029	1.0569	1.2061	0.5215	0.0521
3	2.50000	0.780	0.6606	0.9964	0.5942	0.1111	0.0004
4	1.40000	0.360	0.3570	0.4441	0.1839	0.1334	0.0158
5	0.80000	0.240	0.2064	0.8161	0.0658	0.0109	-0.0274
6	0.40000	0.540	0.6708	0.4068	0.0804	-0.0140	0.0000
7	0.20000	-0.420	-0.3826	-0.1002	-0.0452	0.0546	0.0000
8	0.10000	0.120	0.0865	-0.0381	-0.0310	0.0132	0.0000
9	0.04650	0.120	0.1022	-0.0153	-0.0023	0.0014	0.0000
10	0.02150	0.120	0.1190	-0.0700	0.0000	0.0000	0.0000
11	0.01000	0.120	0.1220	-0.0200	0.0000	0.0000	0.0000
12	0.00465	0.120	0.1250	0.0039	0.0000	0.0000	0.0000

Fluorine

	3*MU	B1 -- B0	B2 -- B0	B3 -- B0	B4 -- B0	B5 -- B0
1	1.650	1.9762	2.5513	2.6672	2.5646	1.9058
2	1.260	1.7752	2.3253	1.7376	1.2249	0.5918
3	0.960	1.6183	1.4749	0.7144	0.3399	0.0746
4	1.290	1.2442	0.8310	0.4163	0.1358	0.0003
5	1.170	1.1578	0.7477	0.2249	0.0764	0.0000
6	1.560	1.4080	0.8339	0.1169	0.0378	0.0000
7	0.840	0.8227	0.2501	0.0876	0.0153	0.0000
8	0.270	0.4000	0.0220	0.0400	0.0000	0.0000
9	0.150	0.2500	0.0080	0.0170	0.0000	0.0000
10	0.120	0.1700	0.0050	0.0070	0.0000	0.0000
11	0.120	0.1350	0.0040	0.0030	0.0000	0.0000
12	0.120	0.1052	0.0027	0.0000	0.0000	0.0000

Sodium

	E MJB	3*MU	B1	B2	B3	B4	B5
			--	--	--	--	--
			B0	B0	B0	B0	B0
1	6.50000	1.800	1.8924	2.4550	2.5122	2.3678	1.6420
2	4.00000	1.500	1.6523	1.6915	1.2199	0.8104	0.2558
3	2.50000	1.200	1.4840	1.0504	0.4346	0.1163	0.0035
4	1.40000	1.020	0.9144	0.6085	0.1626	0.0008	0.0000
5	0.80000	0.930	0.8579	0.5620	0.0689	0.0036	0.0000
6	0.40000	0.240	0.3225	0.3264	0.0443	-0.0041	0.0000
7	0.20000	0.180	0.1461	0.1027	0.0085	0.0602	0.0000
8	0.10000	0.120	0.0941	0.0084	0.0089	0.0000	0.0000
9	0.04650	0.090	0.0900	0.0030	0.0000	0.0000	0.0000
10	0.02150	0.090	0.1000	0.0023	0.0000	0.0000	0.0000
11	0.01000	0.090	0.0950	0.0020	0.0000	0.0000	0.0000
12	0.00465	0.090	0.0870	0.0019	0.0000	0.0000	0.0000

Magnesium

	3*MU	B1	B2	B3	B4	B5
		--	--	--	--	--
		B0	B0	B0	B0	B0
1	1.860	1.6254	1.5170	0.7250	0.7417	0.3067
2	1.590	1.2143	1.4223	1.0407	0.7034	0.0890
3	1.260	0.8327	1.4340	0.4102	0.3542	0.1384
4	0.900	1.0965	0.9704	0.2684	0.0764	0.0242
5	1.050	1.1242	0.8566	0.1478	0.0000	0.0000
6	1.020	1.0566	0.8586	0.0778	0.0000	0.0000
7	0.420	0.4252	0.1000	0.0256	0.0000	0.0000
8	0.120	0.0938	0.2764	0.0015	0.0000	0.0000
9	0.090	-0.0124	0.3700	0.0000	0.0000	0.0000
10	0.090	-0.1735	0.0788	0.0000	0.0000	0.0000
11	0.090	-0.1097	0.0139	0.0000	0.0000	0.0000
12	0.090	0.0819	0.0018	0.0000	0.0000	0.0000

Aluminium

	E MJB	3*MU	B1	B2	B3	B4	B5
			--	--	--	--	--
			B0	B0	B0	B0	B0
1	6.50000	1.920	1.7861	2.4338	2.2485	2.1661	1.4900
2	4.00000	1.710	1.4952	1.5916	1.1569	0.7780	0.3503
3	2.50000	1.410	1.1436	1.0996	0.4302	0.1381	0.0276
4	1.40000	1.080	1.0322	0.6829	0.1700	0.0571	0.0000
5	0.80000	0.870	0.9373	0.4869	0.0469	0.0146	0.0000
6	0.40000	0.600	0.6049	0.1822	0.0186	0.0010	0.0000
7	0.20000	0.330	0.3064	0.0371	0.0014	0.0000	0.0000
8	0.10000	0.180	0.1564	0.0120	-0.0051	0.0000	0.0000
9	0.04650	0.120	0.1000	0.0050	0.0049	0.0000	0.0000
10	0.02150	0.090	0.0830	0.0030	0.0000	0.0000	0.0000
11	0.01000	0.090	0.0760	0.0020	0.0000	0.0000	0.0000
12	0.00465	0.090	0.0740	0.0014	0.0000	0.0000	0.0000

Silicon

	3*MU	B1	B2	B3	B4	B5
		--	--	--	--	--
		B0	B0	B0	B0	B0
1	1.950	1.1160	0.6592	2.2895	1.9442	1.8400
2	1.800	1.2142	1.9171	1.4361	1.0270	0.7563
3	1.560	1.3648	1.4006	0.8030	0.4060	0.2439
4	0.840	0.9596	0.9505	0.2472	0.1627	0.0003
5	0.840	0.9009	0.4287	0.0233	0.0197	0.0000
6	0.420	0.4647	0.2088	0.0283	0.0621	-0.0014
7	0.210	0.2070	0.0010	0.0000	0.0235	0.0000
8	0.150	0.0823	0.0011	0.0000	0.0069	0.0000
9	0.090	0.1700	0.0013	0.0000	0.0000	0.0000
10	0.040	0.1400	0.0013	0.0000	0.0000	0.0000
11	0.040	0.0950	0.0013	0.0000	0.0000	0.0000
12	0.040	0.0714	0.0012	0.0000	0.0000	0.0000

Phosphorus

	E MAE	3*MU	B1	B2	B3	B4	B5
			--	--	--	--	--
			B0	B0	B0	B0	B0
1	6.50000		2.4510	3.1089	2.6880	1.6019	1.0980
2	4.00000		1.9509	2.0887	1.3243	0.5866	0.0962
3	2.50000		1.3961	1.4763	0.5446	0.1591	-0.0054
4	1.40000		1.1765	1.0455	0.1951	0.0252	0.0000
5	0.80000		0.9948	0.7298	0.0467	0.0039	0.0000
6	0.40000		0.8420	0.4420	0.0250	0.0000	0.0000
7	0.20000		0.4857	0.4385	0.0455	0.0000	0.0000
8	0.10000		0.4862	0.2050	0.0260	0.0000	0.0000
9	0.04650		0.4900	0.1800	0.0040	0.0000	0.0000
10	0.02150		0.4400	0.1500	0.0000	0.0000	0.0000
11	0.01000		0.3000	0.0800	0.0000	0.0000	0.0000
12	0.00465		0.0645	0.0011	0.0000	0.0000	0.0000

Sulphur

	3*MU	B1	B2	B3	B4	B5
		--	--	--	--	--
		B0	B0	B0	B0	B0
1		1.8352	2.2474	1.6401	1.1380	0.5509
2		1.7543	2.1599	1.3099	0.7325	0.3281
3		1.2336	1.2643	0.5072	0.2129	0.0665
4		1.1183	0.9841	0.1180	0.0390	0.0000
5		1.1167	0.6797	0.0343	0.0003	0.0000
6		1.0052	0.4436	0.0009	0.0000	0.0000
7		0.7173	0.1560	0.0000	0.0000	0.0000
8		0.3219	0.0575	0.0000	0.0000	0.0000
9		0.2000	0.0400	0.0000	0.0000	0.0000
10		0.1200	0.0200	0.0000	0.0000	0.0000
11		0.0800	0.0100	0.0000	0.0000	0.0000
12		0.0700	0.0060	0.0000	0.0000	0.0000
13		0.0625	0.0010	0.0000	0.0000	0.0000

Potassium

	E MAE	3*MU	B1	B2	B3	B4	B5
			--	--	--	--	--
			B0	B0	B0	B0	B0
1	6.50000	1.890	1.3825	1.8221	1.8074	1.0097	0.9704
2	4.00000	1.590	1.3328	1.8561	1.4315	0.7367	0.4098
3	2.50000	1.290	1.2443	1.5549	0.7798	0.4235	0.1492
4	1.40000	0.990	1.0925	1.2227	0.3480	0.0486	0.0193
5	0.80000	0.840	0.8592	0.9642	0.0995	0.0018	0.0003
6	0.40000	0.780	0.8209	0.5954	0.0157	0.0000	0.0000
7	0.20000	0.420	0.4407	0.2325	0.0010	0.0000	0.0000
8	0.10000	0.360	0.2602	0.0860	0.0000	0.0000	0.0000
9	0.04650	0.180	0.1900	0.0400	0.0000	0.0000	0.0000
10	0.02150	0.120	0.1200	0.0150	0.0000	0.0000	0.0000
11	0.01000	0.090	0.0800	0.0040	0.0000	0.0000	0.0000
12	0.00465	0.060	0.0513	0.0007	0.0000	0.0000	0.0000

Calcium

	3*MU	B1	B2	B3	B4	B5
		--	--	--	--	--
		B0	B0	B0	B0	B0
1	1.890	1.7740	2.4295	2.2294	1.6950	1.1175
2	1.590	1.6304	2.0450	1.3410	0.9566	0.4091
3	1.290	1.3277	1.9131	0.8088	0.5663	0.1579
4	0.840	0.8072	1.3174	0.1528	0.2266	0.0306
5	0.540	0.7543	0.8064	0.0453	0.0706	0.0060
6	0.510	0.6904	0.5141	0.0386	0.0079	0.0000
7	0.270	0.2879	0.1439	0.0013	0.0000	0.0000
8	0.090	0.1144	0.0254	0.0000	0.0000	0.0000
9	0.060	0.1200	0.0120	0.0000	0.0000	0.0000
10	0.060	0.0900	0.0060	0.0000	0.0000	0.0000
11	0.060	0.0700	0.0020	0.0000	0.0000	0.0000
12	0.060	0.0500	0.0007	0.0000	0.0000	0.0000

Titanium

			b1	b2	b3	b4	b5
			b0	b0	b0	b0	b0
1	6.50000	2.22[illegible]	2.4443	3.2990	3.2394	2.6144	1.72761
2	4.00000	1.98[illegible]	1.9[illegible]0	2.6031	2.3041	1.4344	0.82431
3	2.50000	1.65[illegible]	1.4389	1.9992	1.3473	0.7061	0.33911
4	1.40000	1.200	1.[illegible]16	1.5607	0.4322	0.2364	0.05701
5	0.80000	0.930	0.6196	0.9191	0.1087	0.0753	0.00001
6	0.40000	0.450	0.3962	0.4637	0.0437	0.0176	0.00001
7	0.20000	0.210	0.3662	0.2010	0.0031	0.0000	0.00001
8	0.10000	0.090	0.1650	0.0710	0.0000	0.0000	0.00001
9	0.05000	0.060	0.0650	0.0250	0.0000	0.0000	0.00001
10	0.02500	0.030	0.0500	0.0000	0.0000	0.0000	0.00001
11	0.01000	0.030	0.0450	0.0020	0.0000	0.0000	0.00001
12	0.00400	0.030	0.0416	0.0004	0.0000	0.0000	0.00001

Vanadium

			b1	b2	b3	b4	b5
			b0	b0	b0	b0	b0
1	2.130	2.4252	3.2296	3.1934	2.6090	1.5615
2	1.860	2.1232	2.5925	2.4020	1.5366	0.6080
3	1.500	1.4482	2.0314	1.6263	1.0123	0.2074
4	1.080	1.0333	1.6011	0.7378	0.7075	0.0053
5	0.540	0.5606	1.0461	0.1547	0.1921	0.0000
6	0.480	0.4213	0.3782	0.0329	0.0069	0.0000
7	0.210	0.1804	0.0449	0.0000	0.0000	0.0000
8	0.090	0.0938	0.0116	0.0000	0.0000	0.0000
9	0.060	0.0550	0.0040	0.0000	0.0000	0.0000
10	0.030	0.0480	0.0020	0.0000	0.0000	0.0000
11	0.030	0.0430	0.0010	0.0000	0.0000	0.0000
12	0.030	0.0392	0.0004	0.0000	0.0000	0.0000

Chromium

			b1	b2	b3	b4	b5
			b0	b0	b0	b0	b0
1	6.50000	2.40[illegible]	2.4183	3.2838	3.35[illegible]8	2.9090	1.7631
2	4.00000	2.010	2.[illegible]45	2.61[illegible]6	2.47[illegible]4	1.9655	0.7313
3	2.50000	1.35[illegible]	1.3312	1.9412	1.5464	0.8539	0.1268
4	1.40000	0.960	0.9570	1.5414	0.6687	0.2902	0.0214
5	0.80000	0.570	0.5740	0.8720	0.2132	0.1661	0.0000
6	0.40000	0.400	0.4[illegible]9	0.4407	0.1092	0.0460	0.0000
7	0.20000	0.350	0.3277	0.1756	0.0005	0.0208	0.0000
8	0.10000	0.190	0.1800	0.0374	0.0000	0.0000	0.0000
9	0.05000	0.090	0.1700	0.0140	0.0000	0.0000	0.0000
10	0.02500	0.060	0.0610	0.0050	0.0000	0.0000	0.0000
11	0.01000	0.060	0.0450	0.0020	0.0000	0.0000	0.0000
12	0.00400	0.060	0.0405	0.0003	0.0000	0.0000	0.0000

Manganese

			b1	b2	b3	b4	b5
			b0	b0	b0	b0	b0
1			2.3101	3.2113	3.2936	2.4501	1.4688
2			1.7976	2.3820	2.2720	1.6967	0.8444
3			1.2880	1.9771	1.4298	0.7906	0.2857
4			0.8437	1.2929	0.7807	0.2797	0.0660
5			0.5039	0.7930	0.2685	0.0975	0.0000
6			0.4186	0.3236	0.0954	0.0300	0.0000
7			0.2011	0.0495	0.0057	0.0005	0.0000
8			0.0054	0.0004	0.0000	0.0000	0.0000
9			0.0100	0.0100	0.0000	0.0000	0.0000
10			0.0450	0.0050	0.0000	0.0000	0.0000
11			0.0400	0.0040	0.0000	0.0000	0.0000
12			0.0363	0.0004	0.0000	0.0000	0.0000

Iron

1	4.00000	2.400	2.3624	3.2153	3.3256	3.0698	2.0177
2	4.00000	2.190	2.1520	2.5635	2.3350	1.5676	0.6066
3	2.50000	1.560	1.4328	1.9700	1.5666	0.8083	0.1182
4	1.40000	0.980	0.8845	1.4766	0.8913	0.3814	0.0000
5	0.80000	0.720	0.7110	1.0046	0.3448	0.1807	0.0000
6	0.40000	0.510	0.4133	0.4255	0.0431	0.0736	0.0000
7	0.20000	0.240	0.2099	0.1434	0.0206	0.0025	0.0000
8	0.10000	0.150	0.2640	0.0500	0.0000	0.0000	0.0000
9	0.04650	0.090	0.1400	0.0200	0.0000	0.0000	0.0000
10	0.02150	0.060	0.0760	0.0100	0.0000	0.0000	0.0000
11	0.01000	0.040	0.0500	0.0050	0.0000	0.0000	0.0000
12	0.00465	0.030	0.0357	0.0003	0.0000	0.0000	0.0000

Cobalt

1		2.3316	2.2206	3.3505	3.1156	2.0756	
2		2.0309	2.1634	2.7972	2.1026	1.3624	
3		1.3223	1.6412	1.5381	1.0596	0.3038	
4		0.7969	1.1239	0.6518	0.3291	0.0207	
5		0.5073	0.7708	0.2997	0.1216	0.0000	
6		0.3433	0.5425	0.0621	0.0445	0.0000	
7		0.2069	0.1655	0.0070	0.0181	0.0000	
8		0.0960	0.0570	0.0000	0.0060	0.0000	
9		0.0500	0.0150	0.0000	0.0030	0.0000	
10		0.0300	0.0070	0.0000	0.0020	0.0000	
11		0.0270	0.0030	0.0000	0.0000	0.0000	
12		0.0339	0.0003	0.0000	0.0000	0.0000	

Nickel

1	6.50000	2.400	2.3634	3.3609	3.5049	3.1825	2.1779
2	4.00000	2.190	1.8026	2.2410	2.3194	1.9122	1.0233
3	2.50000	1.350	1.3456	1.9124	1.3977	0.9403	0.1764
4	1.40000	0.700	0.9043	1.5179	0.7529	0.3824	0.0013
5	0.80000	0.420	0.4247	0.0514	0.2177	0.1290	0.0000
6	0.40000	0.420	0.3956	0.4105	0.0568	0.0590	0.0000
7	0.20000	0.270	0.2460	0.0997	0.0237	0.0230	0.0000
8	0.10000	0.120	0.1151	0.0157	0.0060	0.0080	0.0000
9	0.04650	0.090	0.0580	0.0040	0.0030	0.0030	0.0000
10	0.02150	0.030	0.0400	0.0030	0.0010	0.0010	0.0000
11	0.01000	0.030	0.0350	0.0020	0.0004	0.0004	0.0000
12	0.00465	0.030	0.0339	0.0003	0.0000	0.0000	0.0000

Copper

1	2.400	2.5646	3.4585	3.4506	3.2704	2.3890		
2	2.190	2.1094	2.7769	2.7396	2.3390	1.3585		
3	1.560	1.5510	1.9176	2.1194	1.3049	0.4511		
4	0.870	0.9666	1.2307	0.9961	0.4635	0.0780		
5	0.490	0.5597	0.6436	0.2900	0.1342	0.0143		
6	0.330	0.3558	0.2606	0.0771	0.0306	0.0000		
7	0.210	0.2459	0.0976	0.0381	0.0384	0.0000		
8	0.120	0.1351	0.0186	0.0000	0.0215	0.0000		
9	0.060	0.0500	0.0100	0.0000	0.0100	0.0000		
10	0.030	0.0400	0.0060	0.0000	0.0050	0.0000		
11	0.030	0.0300	0.0040	0.0000	0.0020	0.0000		
12	0.030	0.0313	0.0003	0.0000	0.0000	0.0000		

Zinc

		E_ABS	3*RMU	B1	B2	B3	B4	B5
				--	--	--	--	--
				B0	B0	B0	B0	B0
1	6.50000			2.3793	3.3843	3.5973	3.4814	2.5449
2	4.00000			1.9130	2.7115	2.8647	2.3235	1.5362
3	2.50000			1.5026	2.1563	2.1097	1.4440	0.7103
4	1.40000			1.0722	1.4922	1.1445	0.6947	0.2832
5	0.80000			0.8381	0.6422	0.1876	0.1036	0.0274
6	0.40000			0.3847	0.2599	0.0519	0.0292	0.0000
7	0.20000			0.2302	0.2235	0.0266	0.0075	0.0000
8	0.10000			0.1151	0.1151	0.0105	0.0000	0.0000
9	0.04650			0.0600	0.0600	0.0020	0.0000	0.0000
10	0.02150			0.0400	0.0300	0.0000	0.0000	0.0000
11	0.01000			0.0300	0.0100	0.0000	0.0000	0.0000
12	0.00465			0.0300	0.0000	0.0000	0.0000	0.0000

Yttrium

		3*RMU	B1	B2	B3	B4	B5
			--	--	--	--	--
			B0	B0	B0	B0	B0
1	2.250	2.4035	2.1832	3.5383	3.6500	3.3893
2	1.530	1.6122	1.0732	1.8981	2.3122	1.9359
3	1.080	1.1683	1.3581	0.8992	1.4459	0.6199
4	1.080	1.0167	1.0003	0.4256	0.4404	0.0837
5	1.080	1.0489	0.4381	0.0486	0.0053	0.0000
6	0.780	0.9388	0.1221	0.0000	0.0000	0.0000
7	0.450	0.6705	0.0386	0.0000	0.0000	0.0000
8	0.210	0.3585	0.0227	0.0000	0.0000	0.0000
9	0.090	0.1600	0.0140	0.0000	0.0000	0.0000
10	0.060	0.0900	0.0070	0.0000	0.0000	0.0000
11	0.030	0.0500	0.0030	0.0000	0.0000	0.0000
12	0.030	0.0225	0.0001	0.0000	0.0000	0.0000

Zirconium

		E_ABS	3*RMU	B1	B2	B3	B4	B5
				--	--	--	--	--
				B0	B0	B0	B0	B0
1	6.50000	2.25		2.2683	3.1123	3.1714	3.3774	3.0684
2	4.00000	1.74		1.6093	2.0391	2.0809	2.4604	2.0033
3	2.50000	1.29		1.3198	1.4943	1.0714	1.4132	0.7817
4	1.40000	1.11		1.1016	1.2561	0.5309	0.5594	0.2183
5	0.80000	1.08		1.1191	0.9362	0.2143	0.1338	0.0703
6	0.40000	0.81		0.8993	0.6139	0.1023	0.0512	0.0505
7	0.20000	0.42		0.4296	0.3396	0.0194	0.0152	0.0049
8	0.10000	0.24		0.2365	0.2039	0.0012	0.0018	0.0000
9	0.04650	0.12		0.1200	0.1500	0.0040	0.0000	0.0000
10	0.02150	0.06		0.0600	0.0800	0.0020	0.0000	0.0000
11	0.01000	0.03		0.0300	0.0400	0.0010	0.0000	0.0000
12	0.00465	0.03		0.0219	0.0000	0.0000	0.0000	0.0000

Niobium

		3*RMU	B1	B2	B3	B4	B5
			--	--	--	--	--
			B0	B0	B0	B0	B0
1	2.250	2.2180	2.9905	3.1778	3.2682	2.9556
2	2.010	1.7773	2.1636	2.4998	2.3150	1.6866
3	1.800	1.8060	2.0728	1.3815	1.4387	0.5526
4	1.500	1.6751	1.5608	0.7323	0.6487	0.2261
5	1.170	1.2304	0.8491	0.2096	0.1081	0.0580
6	0.840	0.8534	0.4688	0.0526	0.0488	0.0207
7	0.510	0.5200	0.2382	0.0000	0.0000	0.0056
8	0.270	0.2616	0.1310	0.0000	0.0000	0.0000
9	0.150	0.1400	0.0700	0.0000	0.0000	0.0000
10	0.090	0.0800	0.0300	0.0000	0.0000	0.0000
11	0.060	0.0500	0.0150	0.0000	0.0000	0.0000
12	0.030	0.0215	0.0001	0.0000	0.0000	0.0000

Molybdenum

I	E MOL	3*MU	B1 -- B0	B2 -- B0	B3 -- B0	B4 -- B0	B5 -- B0
1	6.50000	2.250	1.9552	2.5492	2.7537	2.8538	2.3164
2	4.00000	1.950	1.6168	1.9862	1.8943	2.2593	1.4254
3	2.50000	1.650	1.4459	1.6866	1.6709	1.4075	0.5226
4	1.40000	1.380	1.4627	1.4775	0.6950	0.6141	0.1581
5	0.80000	1.260	1.2754	1.0219	0.3194	0.1335	0.0247
6	0.40000	0.930	0.9436	0.6637	0.1030	0.0291	0.0006
7	0.20000	0.600	0.5854	0.4667	0.0336	0.0093	0.0000
8	0.10000	0.330	0.3204	0.2837	0.0123	0.0025	0.0000
9	0.04650	0.210	0.1900	0.1700	0.0060	0.0040	0.0000
10	0.02150	0.120	0.1300	0.0800	0.0030	0.0020	0.0000
11	0.01000	0.060	0.0700	0.0400	0.0020	0.0000	0.0000
12	0.00465	0.030	0.0209	0.0001	0.0000	0.0000	0.0000

Tin

I	3*MU	B1 -- B0	B2 -- B0	B3 -- B0	B4 -- B0	B5 -- B0
1		2.0861	2.6772	2.9824	3.2514	3.4703
2		1.7917	2.2804	2.2204	2.0369	2.0939
3		1.7144	2.0082	1.3051	0.8236	0.5604
4		1.4506	1.5952	0.6654	0.3450	0.0972
5		1.2678	1.1526	0.2793	0.1666	0.0319
6		1.1892	0.7859	0.1152	0.0590	0.0115
7		0.9675	0.4622	0.0486	0.0245	0.0044
8		0.5486	0.2451	0.0238	0.0112	0.0010
9		0.2400	0.1200	0.0000	0.0050	0.0000
10		0.1200	0.0500	0.0000	0.0000	0.0000
11		0.0000	0.0200	0.0000	0.0000	0.0000
12		0.0168	0.0001	0.0000	0.0000	0.0000

Tantalum

I	E MOB	3*MU	B1 -- B0	B2 -- B0	B3 -- B0	B4 -- B0	B5 -- B0
1	6.50000	2.490	2.1807	2.9718	3.3582	3.4508	3.3107
2	4.00000	2.340	2.1851	2.8440	3.0524	2.9213	2.2279
3	2.50000	2.100	2.1076	2.4736	2.5807	1.9200	1.0280
4	1.40000	1.800	2.0077	2.3248	2.3257	1.2189	0.3487
5	0.80000	1.350	1.4871	1.5212	1.0548	0.4048	0.0836
6	0.40000	0.960	0.9373	0.7707	0.2572	0.0716	0.0162
7	0.20000	0.570	0.5329	0.3172	0.0440	0.0068	0.0000
8	0.10000	0.330	0.2700	0.1209	0.0096	0.0000	0.0000
9	0.04650	0.150	0.1300	0.0600	0.0050	0.0000	0.0000
10	0.02150	0.060	0.0600	0.0200	0.0030	0.0000	0.0000
11	0.01000	0.030	0.0300	0.0100	0.0010	0.0000	0.0000
12	0.00465	0.000	0.0110	0.0000	0.0000	0.0000	0.0000

Tungsten

I	3*MU	B1 -- B0	B2 -- B0	B3 -- B0	B4 -- B0	B5 -- B0
1	2.490	2.0257	2.7159	3.0868	3.3821	3.1935
2	2.340	2.3303	2.9947	3.2950	2.9916	2.4703
3	2.100	2.1162	2.6133	2.6873	1.9760	1.0649
4	1.800	1.8745	2.2427	2.1575	1.2692	0.4360
5	1.320	1.5856	1.6923	1.1456	0.4441	0.1426
6	0.810	0.9351	0.8782	0.3393	0.1104	0.0359
7	0.480	0.4379	0.2675	0.0696	0.0225	0.0075
8	0.240	0.1735	0.0550	0.0113	0.0040	0.0017
9	0.120	0.0700	0.0150	0.0040	0.0020	0.0010
10	0.060	0.0300	0.0050	0.0030	0.0010	0.0000
11	0.030	0.0200	0.0000	0.0020	0.0000	0.0000
12	0.000	0.0109	0.0000	0.0000	0.0000	0.0000

Lead

I	E MEV	3*MU	B1 / B0	B2 / B0	B3 / B0	B4 / B0	B5 / B0
1	6.50000	2.520	2.1352	2.9910	3.6691	3.8444	3.8182
2	4.00000	2.280	1.8935	2.6063	2.8611	2.8056	2.0729
3	2.50000	1.560	1.4721	1.8722	1.9376	1.6356	0.7102
4	1.40000	0.930	1.1141	1.2234	1.6999	0.9109	0.1467
5	0.80000	0.600	0.6797	0.8067	1.0068	0.4465	0.0796
6	0.40000	0.390	0.4337	0.5759	0.3596	0.1390	0.0370
7	0.20000	0.420	0.4554	0.3289	0.0793	0.0461	0.0449
8	0.10000	0.300	0.2685	0.0856	0.0166	0.0255	0.0046
9	0.04650	0.150	0.1500	0.0300	0.0080	0.0240	0.0000
10	0.02150	0.060	0.0070	0.0100	0.0040	0.0120	0.0000
11	0.01000	0.030	0.0040	0.0050	0.0020	0.0050	0.0000
12	0.00465	0.000	0.0097	0.0000	0.0000	0.0000	0.0000

Bismuth

I	3*MU	B1 / B0	B2 / B0	B3 / B0	B4 / B0	B5 / B0
1	2.460	2.2958	3.1945	3.7101	4.0382	3.8003
2	2.160	2.1194	2.8419	3.1212	3.0536	2.4923
3	1.500	1.4434	1.8934	1.9479	1.7785	0.9284
4	0.930	1.0243	1.2658	1.6458	1.1709	0.2736
5	0.630	0.6313	0.6013	0.9884	0.3608	0.0454
6	0.420	0.4220	0.4189	0.3160	0.0977	0.0372
7	0.300	0.3008	0.1664	0.0538	0.0050	0.0081
8	0.210	0.2110	0.0481	0.0100	0.0000	0.0004
9	0.150	0.1500	0.0080	0.0020	0.0000	0.0000
10	0.060	0.1000	0.0000	0.0000	0.0000	0.0000
11	0.000	0.0600	0.0000	0.0000	0.0000	0.0000
12	0.000	0.0095	0.0000	0.0000	0.0000	0.0000

Thorium

I	E MEV	3*MU	B1 / B0	B2 / B0	B3 / B0	B4 / B0	B5 / B0
1	6.50000	2.520	2.3957	3.3641	4.0353	4.6357	4.4874
2	4.00000	2.400	2.2525	3.2020	3.5123	3.6432	3.1400
3	2.50000	2.130	2.0500	2.7030	2.9304	2.9355	2.2366
4	1.40000	1.590	1.7400	1.9812	2.3385	2.0375	1.1944
5	0.80000	1.260	1.3120	1.2203	1.1779	0.6218	0.1820
6	0.40000	0.990	1.0282	0.7099	0.3721	0.1207	0.0358
7	0.20000	0.630	0.6247	0.2944	0.0654	0.0043	0.0118
8	0.10000	0.360	0.3717	0.1074	0.0209	0.0000	0.0060
9	0.04650	0.210	0.2600	0.0400	0.0100	0.0000	0.0030
10	0.02150	0.120	0.1500	0.0100	0.0050	0.0000	0.0010
11	0.01000	0.060	0.0800	0.0050	0.0020	0.0000	0.0000
12	0.00465	0.030	0.0086	0.0000	0.0000	0.0000	0.0000

Uranium-235

I	3*MU	B1 / B0	B2 / B0	B3 / B0	B4 / B0	B5 / B0
1	2.520	2.4075	3.5523	4.2160	4.6301	4.5595
2	2.400	2.4576	3.4771	3.8823	3.8030	3.6470
3	2.130	2.1225	2.5951	3.0238	2.7888	2.3850
4	1.650	1.6668	1.7095	2.3047	1.8645	1.1691
5	1.350	1.3886	1.2437	1.3592	0.6733	0.1614
6	1.050	1.0829	0.7377	0.3896	0.1424	0.0185
7	0.690	0.7104	0.3431	0.0954	0.0402	0.0000
8	0.390	0.4043	0.1404	0.0332	0.0166	0.0000
9	0.210	0.2300	0.0600	0.0150	0.0070	0.0000
10	0.120	0.1200	0.0300	0.0070	0.0030	0.0000
11	0.060	0.0300	0.0100	0.0010	0.0000	0.0000
12	0.030	0.0085	0.0000	0.0000	0.0000	0.0000

Uranium-238

I	E MEV	3*MU	B1 / B0	B2 / B0	B3 / B0	B4 / B0	B5 / B0
1	6.50000	2.520	2.4145	3.2481	3.8105	3.8070	3.6015
2	4.00000	2.400	2.2650	3.0926	3.4751	3.3733	2.9085
3	2.50000	2.130	2.1614	2.8510	3.0173	2.8899	2.2425
4	1.40000	1.590	1.5624	1.7177	1.8366	1.4729	0.6023
5	0.80000	1.260	1.3401	1.2014	1.0270	0.5760	0.0162
6	0.40000	0.990	1.0273	0.7551	0.3328	0.1571	-0.0384
7	0.20000	0.630	0.6464	0.3307	0.0392	0.0361	-0.0428
8	0.10000	0.360	0.3481	0.1138	-0.0181	0.0315	-0.0244
9	0.04650	0.210	0.1700	0.0400	-0.0100	0.0130	0.0000
10	0.02150	0.120	0.0700	0.0150	-0.0050	0.0050	0.0000
11	0.01000	0.060	0.0300	0.0070	0.0000	0.0000	0.0000
12	0.00465	0.030	0.0084	0.0000	0.0000	0.0000	0.0000

Plutonium-239

I	3*MU	B1 / B0	B2 / B0	B3 / B0	B4 / B0	B5 / B0
1	2.520	2.3301	3.3264	4.0428	4.3842	4.1996
2	2.400	2.3015	3.1532	3.5209	3.6050	3.0345
3	2.130	1.9970	2.4223	2.5343	2.6887	1.6926
4	1.650	1.6564	1.8058	2.0469	1.6766	0.7274
5	1.350	1.3772	1.2671	1.2685	0.6555	0.1703
6	1.050	1.0583	0.6986	0.4185	0.1371	0.0259
7	0.690	0.6877	0.2068	0.0938	0.0251	0.0006
8	0.390	0.3543	0.0652	0.0276	0.0051	0.0000
9	0.210	0.1800	0.0250	0.0130	0.0000	0.0000
10	0.120	0.0800	0.0100	0.0060	0.0000	0.0000
11	0.060	0.0400	0.0050	0.0030	0.0000	0.0000
12	0.030	0.0084	0.0000	0.0000	0.0000	0.0000

GROUP CROSS-SECTIONS FOR THE CAPTURE OF FAST NEUTRONS BY FISSION FRAGMENTS

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Since the compilation of the 26-group system of constants for fission fragments in 1962 and 1963 [1] a large amount of experimental data on the capture cross-sections of various fission products has appeared, making it possible not only to improve our calculation of the cross-section for all fragments together, but also to forecast reasonably reliably in a wide energy region how the capture cross-section develops for individual fission product nuclei.

Predictions can be made on the basis of various nuclear reaction models, the model parameters selected being those that give the best theoretical description of the available experimental data. The density of the network of experimental points in the space (A, E) determines the reliability of the results obtainable from calculations of this kind.

Work of this nature - covering the energy region from 1 keV to 10 MeV for stable nuclei with $32 \leqslant Z \leqslant 66$ resulting from fission - was carried out in 1969 by the Benzi group in Italy [2, 3].

In the present report we give the results of averaging the fragment capture cross-sections evaluated by Benzi and co-workers over the standard spectrum adopted in Ref.[1] (fission spectrum above 2.5 MeV, Fermi spectrum below that energy) within the groups of the 26-group breakdown [1].

Group constants in 1 to 14 groups are given both for individual isotopes and for their natural mixtures. For elements for which in Ref.[1] and the later supplements [4, 5, 6] there are no complete tables of group constants, these data can be recommended for direct use.

The method of calculating the cross-sections in Ref.[2]consisted of five stages:

1. From the bibliographic system (CINDA) and the data library (NEUDADA) all relevant information was extracted concerning the experimental data on capture cross-sections for each of the elements considered. In cases where there was a reference in the CINDA system and where the corresponding files were not present in the NEUDADA library, the data were taken directly from the literature;

2. In some cases relative measurements were converted into more modern standard cross-sections. For this purpose calculations were first made of the capture cross-sections of I, In and Ta and of the fission cross-section of ^{235}U;

3. Resonance parameters in the resolved resonance region were analysed to obtain average resonance parameters. Data for level schemes were collected;

4. As a first approximation resonance parameters obtained from the resolved resonance region were used in calculating $\sigma_{n\gamma}$. The calculations were compared with experimental results on capture cross-sections and, where necessary, the parameters were adjusted with a view to achieving agreement with the experimental curve. The sum of the capture cross-section curves for individual isotopes was compared with the curve for the element;

5. In some cases the theoretical data were corrected, for example to reproduce the behaviour of the cross-sections in the low-energy region, which is not given by the model, or to eliminate false peaks resulting from inaccuracies in the formulae applied.

The calculation of the capture cross-sections was carried out in the main on the basis of the Hauser Feshbach theory; the method is described in detail in Ref.[7]. The penetration factors necessary for the calculations were determined in the strong interaction approximation (see Ref.[8]). In the region of resolved inelastic scattering levels the competition between inelastic scattering and capture was taken into account in detail; at higher energies

it was averaged on the basis of the energy dependence adopted for the level density. In the region of high level density an averaged formula [9] was used instead of the detailed Hauser Feshbach formula.

In allowing for the energy dependence of the radiation width, the effect of the giant dipole resonance was taken into account as proposed by Axel [10].

The calculations showed that at energies below 1 keV the differences between the formulae for the probability of radiation transition of the excited nucleus proposed by Axel [10] and Weisskopf [11] have virtually no effect on the results.

The level density was calculated on the basis of the Fermi gas model, with allowance for the pairing energy. The values of the a-parameter for the density of single-particle states near the Fermi surface were determined from the systematics.

To the compound nucleus capture cross-section was added the direct capture cross-section calculated by the method of Lane and Lynn [12], approximate account being taken of the shell effects (see Ref. [2]). Collective mechanisms were taken into account by means of the Brown coefficient [13, 2]. In the high-energy region the $(n,2\gamma)$ process was taken into account [14]. The giant resonance parameters were taken from the Goryachev systematics [15]. A summary of the working formulae is given in Ref. [2], which also contains tables showing the calculation methods and values of theoretical parameters used in specific cases, viz:

1. The energy regions in which calculations were carried out by one formula or another;
2. B(N) - the binding energy of the neutron in the compound nucleus (MeV);
3. $\overline{\Gamma}_\gamma$ - the average radiation width at B_n(eV);
4. $\overline{D}_{obs}$ - the observed distance between levels at B_n(eV);
5. $S_\gamma = [\overline{\Gamma}_\gamma/\overline{D}_{obs}] \times 10^3$;

6. A(c) and A(t) - the parameter a of the level density of the compound nucleus or target nucleus (MeV^{-1});

7. D(c) and D(t) - the correction for the pairing energy - Δ of the level density of the nucleus or target nucleus (MeV);

8. R_o and r_o - the radius of the nucleus and the constant where $R_o = r_o A^{1/3}$ (Fermi);

9. E_R, Γ_R - the energy and width of the giant resonance (MeV);

10. I - the spin of the ground state of the target nucleus;

11. The level scheme of inelastic scattering (E_I = the energy of the first level, in MeV).

Some of these initial data are presented in this report (Table 1).

Benzi and Reffo [2] note that for many fission fragments the errors in the cross-sections calculated by them can amount to 50%. Obviously, the less experimental information one has the poorer the reliability of the data becomes. In Table 1, therefore, we indicate where experimental data on one isotope or another are available and the degree of accuracy achieved in describing them. These indications were compiled on the basis of the calculation graphs with experimental points presented in Ref. [3].

The results of averaging the calculated capture cross-section of Benzi and co-workers for the first fourteen groups of the 26-group constant system (1 keV-10.5 MeV) are given in Table 2. Table 2 contains capture cross-sections calculated for natural mixtures of various elements (the isotopic fractions in the natural mixtures were taken from Gordeev and co-workers [21]). In the notes on Table 2 the group capture cross-sections obtained in this work are compared with those published earlier.

Finally, the table includes capture cross-sections for fission fragments of ^{233}U, ^{235}U and ^{239}Pu calculated on the basis of the total yields given in Table 2 (the three lines at the bottom of the table) and compiled in accordance with Cenacchi [22].

TABLE 1

Target nucleus	Target nucleus spin I	B_n	D_{obs}	Γ_γ	A(c)	R_o	Region of experimental points (E)	Agreement between calculated and experimental values
		MeV	eV	MeV	MeV^{-I}	Fermi	keV	
I	2	3	4	5	6	7	8	9
Ge							30,85	good
Ge-70	0	7.415	3542	350	I0.00	5.I52		
Ge-72	0	6.785	3790	300	I0.60	5.200		
Ge-73	9/2	I0.I96	96	240	I0.20	5.224		
Ge-74	0	6.486	5304	250	I0.60	5.248	8.5+4000	good
Ge-76	0	6.030	3489	260	II.70	5.295	25	good
As-75	3/2	7.326	74	300	II.65	5.272	3+6000	Below 30 keV the curve runs 20 to 50% below the points
Se							25+850(5τ)	Wide scatter of points
Se-74	0	8.026	I628	300	I0.40	5.248		
Se-76	0	7.415	I237	300	II.35	5.295		
Se-77	I/2	I0.49I	I00	360	II.65	5.3I8		
Se-78	0	6.97I	II4I	350	I2.00	5.34I		
Se-80	0	6.7I5	5598	200	I0.50	5.386	I2+3200	good
Se-82	0	7.4	2927	250	I0.60	5.43I		
Br							I+4600	good
Br-79	3/2	7.879	45.2	350	II.80	5.364	25+4000	good
Br-8I	3/2	7.597	90	I90	II.40	5.408	25+4000	satisfactory
Kr								
Kr-78	0	8.383	630	3I0	II.20	5.34I		
Kr-80	0	7.850	745	300	II.60	5.386		
Kr-82	0	7.467	793	265	I2.00	5.43I		
Kr-83	9/2	I0.5I9	32	240	II.30	5.453		
Kr-84	0	7.I22	6863	230	I0.00	5.474		
Kr-86	0	5.5II	26I20	I90	I0.20	5.5I8		

TABLE 1

continued

I	2	3	4	5	6	7	8	9
Rb							I÷400	good
Rb-85	5/2	8.637	I27	230	9.94	5.496	I÷2500	good
Rb-87	3/2	6.I30	I3I9	I90	I0.I0	5.539	25÷4000	good
Sr							25÷850(5T)	Wide scatter of points; curve passes through bottom
Sr-84	0	8.482	425	265	II.7I	5.474		
Sr-86	0	8.437	2I67	230	I0.I0	5.5I8	25÷I30(4T)	good
Sr-87	9/2	II.I00	308	205	8.79	5.539	25÷I30(4T)	good
Sr-88	0	6.393	7000	I90	I0.84	5.560		
Y -89	I/2	6.869	2.505	I90	9.58	5.58I	I2÷4000	satisfactory
Zr							I÷I000	good
Zr-90	0	7.I94	6254	I90	I0.20	5.602	I÷50	good
Zr-9I	5/2	8.640	572	I80	I0.70	5.622	I÷60	good
Zr-92	0	6.750	3286	I60	II.45	5.643	30	good
Zr-94	0	6.468	3982	I55	II.6I	5.684	I.5÷200	good
Zr-96	0	5.575	4II7	I70	I2.82	5.724	25÷200(3T)	wide scatter of points
Nb-93	9/2	7.2I3	87	I60	II.20	5.663	I÷I400	good
Mo							I-I000	satisfactory
Mo-92	0	8.053	3245	I90	I0.I7	5.643		
Mo-94	0	7.374	I936	I60	II.44	5.684		
Mo-95	5/2	9.I57	95	I60	I2.30	5.704	I÷45	satisfactory
Mo-96	0	6.8I6	907	I30	I3.I0	5.724	I÷50	good
Mo-97	5/2	8.642	75	I90	I3.22	5.743	I÷60	good
Mo-98	0	5.9I8	II56	I60	I4.II	5.763	I÷3000	wide scatter of points; below 50 keV the curve passes through the bottom points
Mo-I00	0	5.390	I56I	I35	I4.60	5.802	I÷6000	
Ru							I÷I000	good
Ru-96	0	8.040	3I0	I80	I2.88	5.724	25,200	good
Ru-98	0	7.469	666	I70	I2.70	5.763		
Ru-99	5/2	9.67I	28.6	I80	I3.20	5.783		
Ru-I00	0	6.806	638	I80	I3.65	5.802		
Ru-I0I	5/2	9.2I6	I7	I60	I4.42	5.82I		
Ru-I02	0	6.248	229	I70	I5.99	5.840	25,200	good
Ru-I04	0	5.976	662	I50	I5.00	5.878	25÷3000(4T)	wide scatter of points

TABLE 1

continued

I	2	3	4	5	6	7	8	9
Rh-I03	I/2	7.002	33	I95	I4.73	5.859	I+4000	good
Pd	0						I+I60	good
Pd-I02	0	7.608	278	I80	I3.70	5.840		
Pd-I04	0	7.09I	29I	I60	I4.40	5.878		
Pd-I05	5/2	9.548	9.55	I50	I4.80	5.897		
Pd-I06	0	6.532	339	I40	I5.I0	5.9I6		
Pd-I08	0	6.I50	4I5	I20	I5.50	5.953	25-200(4T)	good
Pd-II0	0	5.740	624	I40	I5.70	5.989	25+4000(4T)	good
Ag							I+I000	good
Ag-I07	I/2	7.275	2I	I30	I5.I0	5.934	3+4000	good
Ag-I09	I/2	6.824	I9	I35	I5.90	5.97I	3+600	good
Cd							I+800	In the 50-500 keV range the curve passes 20-50% higher than the points
Cd-I06	0	7.929	52.5	I80	I5.50	5.9I6		
Cd-I08	0	7.38I	I36	I55	I5.I0	5.953		
Cd-II0	0	6.975	I67	I35	I5.50	5.989		
Cd-III	I/2	9.399	30	II0	I5.08	6.007		
Cd-II2	0	6.538	25I	I05	I5.70	6.025		
Cd-II3	I/2	9.048	25.9	I00	I5.80	6.043		
Cd-II4	0	6.I43	I64	I00	I7.I0	6.06I	25,	The curve runs 30% above the points
Cd-II6	0	5.764	653	84	I5.80	6.096	25	The curve runs 50% below the points
In							I+I000	at 30 keV the curve runs 20-50% below the points
In-II3	9/2	7.3I2	7.32	70	I4.54	6.043	350-I000	good
In-II5	9/2	6.725	9.I4	75	I5.I0	6.079	25+I500	good
Sn							25+I000	good
Sn-II2	0	7.744	I58	II0	I4.52	6.025		
Sn-II4	0	7.537	352	95	I3.84	6.06I		
Sn-II5	I/2	9.563	99	88	I3.50	6.079		
Sn-II6	0	6.94I	4I7	65	I4.50	6.096	9.5+50	good
Sn-II7	I/2	9.33I	57	II0	I4.50	6.II4	8.5+50	good
Sn-II8	0	6.48I	I05I	80	I4.00	6.I3I	8.5+50	good
Sn-II9	I/2	9.II0	77	II0	I4.45	6.I48	8.5+50	good
Sn-I20	0	6.I8I	I53I	70	I4.00	6.I66	9 + 50	good

TABLE 1

continued

I	2	3	4	5	6	7	8	9
Sn-I22	0	5.932	2II6	80	I4.00	6.200	30÷4000(4T)	good
Sn-I24	0	5.767	3074	80	I3.80	6.233	30	good
Sb							I÷I000	In the 10-100 keV region the curve runs 20% above the points
Sb-I2I	5/2	6.798	9.6	86	I5.80	6.I83	25,200	wide scatter of points
Sb-I23	7/2	6.432	34	86	I4.37	6.2I7	20,25,200	wide scatter of points
Te							25,30,65	wide scatter of points
Te-I20	0	6.976	I67	84	I5.80	6.I66		
Te-I22	0	6.943	225	I00	I5.50	6.200	30÷I25	good
Te-I23	I/2	9.408	I9	I00	I5.90	6.2I7	30÷I25	good
Te-I24	0	6.603	499	I00	I5.00	6.233	I÷I25	good
Te-I25	I/2	9.092	48	I00	I5.20	6.250	I÷I25	good
Te-I26	0	6.3I4	74I	65	I4.97	6.267	I÷I25	good
Te-I28	0	6.II6	2700	65	I3.55	6.300	I÷I25	good
Te-I30	0	5.895	6290	65	I2.7[illegible]	6.332	I÷I25	good
J -I27	5/2	6.797	I3	I00	I5.60	6.283	I÷5500	good
Xe								
Xe-I24	0	7.6I0	88	86	I5.80	6.233		
Xe-I26	0	7.200	I57	90	I5.7[illegible]	6.267		
Xe-I28	0	6.9I3	245	95	I5.6[illegible]	6.300		
Xe-I29	I/2	9.259	34	I05	I5.5[illegible]	6.3I6		
Xe-I30	0	6.603	395	II0	I5.5[illegible]	6.332		
Xe-I3I	3/2	8.932	34	II0	I5.I[illegible]	6.348		
Xe-I32	0	6.53I	735	II0	I4.8[illegible]	6.365		
Xe-I34	0	6.560	I600	II0	I3.7[illegible]	6.397		
Xe-I36	0	4.460	I4760	92	I4.I[illegible]	6.428		
Cs-I33	7/2	6.705	22	I25	I4.8[illegible]	6.38I	I÷I60	Below 20 keV the curve runs 40% above the points
Ba-							30,65	good
Ba-I30	0	7.633	I04	95	I5.7[illegible]	6.332		
Ba-I32	0	7.370	I97	I08	I5.3[illegible]	6.365		
Ba-I34	0	7.200	360	II0	I4.8[illegible]	6.397		
Ba-I35	3/2	9.230	45	I06	I4.4[illegible]	6.4I2		

TABLE 1

continued

I	2	3	4	5	6	7	8	9
Ba-I36	0	6.952	I052	I00	I3.80	6.428		
Ba-I37	3/2	8.540	2I4	95	I3.40	6.444		In the 100-1500 keV region the curve values are twice those of the points
Ba-I38	0	4.7I7	I4940	50	I3.70	6.460	25÷4000	
La							I÷3000	satisfactory
La-I38	5	8.792	39	99	I2.70	6.460		
La-I39	7/2	5.000	484	80	I3.43	6.475		
Ce							30,65,400	wide scatter of points
Ce-I36	0	7.840	I86	II0	I4.80	6.428		
Ce-I38	0	7.508	656	II0	I3.70	6.460		
Ce-I40	0	5.438	3000	70	I4.86	6.49I	25.	good
Ce-I42	0	5.I05	I000	50	I7.34	6.52I	200.	good
Pr-I4I	5/2	5.853	II4	75	I4.56	6.506	I÷3000	satisfactory
Nd								
Nd-I42	0	6.I00	2340	92	I4.I5	6.52I		
Nd-I43	7/2	7.830	34	70	I6.07	6.537		
Nd-I44	0	5.744	677		I6.65	6.552		
Nd-I45	7/2	7.56I	24.I	65	I7.I0	6.567		
Nd-I46	0	5.288	370	67	I8.70	6.582		
Nd-I48	0	5.042	2I7	50	20.35	6.6I2	I60÷2500	satisfactory
Nd-I50	0	5.4I0	II3	76	20.60	6.642	I80÷2500	satisfactory
Sm							I÷I80	The curve runs 30-100% below the points
Sm-I44	0	6.763	6I0	95	I5.00	6.552	30.	good
Sm-I47	7/2	8.I42	6.5	95	I8.00	6.597	30.	good
Sm-I48	0	5.846	I67	66	I8.80	6.6I2	25,30	good
Sm-I49	7/2	7.98I	3.I	95	I9.50	6.627	30.	good
Sm-I50	0	5.609	97	80	20.35	6.642	25,30	good
Sm-I52	0	5.886	58	66	20.60	6.67I	25-200(4T)	good
Sm-I54	0	5.8I9	I00	95	I9.9I	6.700	25÷6000	Above 100 keV the curve values are twice those of the points

TABLE 1

continued

1	2	3	4	5	6	7	8	9
Eu							I+200	curve 30-100% low
Eu-151	5/2	6.291	0.97	90	21.12	6.656	I+2500	curve 30-100% low
Eu-153	5/2	6.385	I	95	20.90	6.686	I+40	Below 30 keV the curve runs up to 50% below points
Gd							I+180	Below 30 keV the curve runs up to 50% below points
Gd -152	0	6.480	29	57	20.35	6.671		
Gd -154	0	6.456	16	63	21.52	6.700		
Gd -155	3/2	8.527	2.18	100	20.11	6.715		
Gd -156	0	6.347	47	82	19.99	6.729		
Gd -157	3/2	7.920	5.04	86	20.10	6.743		
Gd -158	0	6.031	72	89	20.06	6.758	5+3000	satisfactory
Gd -160	0	5.65	144	98	19.86	6.786	25,3000	Curve 2-3 times higher than points
Tb-159	3/2	6.400	3.03	110	20.00	6.772	I+3000	good
Dy							I+180	satisfactory
Dy -156	0	6.830	23	960	20.10	6.729		
Dy -158	0	6.851	26	100	19.90	6.758		
Dy -160	0	6.448	49	100	19.80	6.786		
Dy -161	5/2	8.204	2.06	116	20.35	6.800	30+180	good
Dy -162	0	6.253	132	117	18.70	6.814	30+150	good
Dy -163	5/2	7.656	6.25	103	19.80	6.828	30+150	good
Dy -164	0	5.635	167	100	19.80	6.842	25.	Curve values twice those of points

TABLE 2

Multigroup capture cross-sections and total yields of stable fission fragments

Energies of groups, keV	i	Elements $_{32}Ge^{70}$	Ge^{72}	Ge^{73}	Ge^{74}	Ge^{76}	Ge	$_{33}As^{75}$
Capture cross-section								
6500-10500	1	0.00118	0.00088	0.00046	0.00045	0.00060	0.00073	0.00189
4000 - 6500	2	0.00387	0.00388	0.00115	0.00159	0.00237	0.00271	0.00558
2500 - 4000	3	0.0114	0.00744	0.00242	0.00431	0.00597	0.00861	0.0120
1400 - 2500	4	0.0121	0.00789	0.0128	0.00405	0.00752	0.00769	0.0227
800 - 1400	5	0.0296	0.0117	0.0570	0.00443	0.00734	0.01585	0.0274
400 - 800	6	0.0295	0.0259	0.0678	0.0137	0.0172	0.02470	0.0459
200 - 400	7	0.0311	0.0269	0.0851	0.0181	0.0268	0.02899	0.1347
100 - 200	8	0.0359	0.0311	0.1315	0.0217	0.0307	0.03630	0.2334
46.5 - 100	9	0.0453	0.0383	0.1976	0.0258	0.0373	0.04729	0.3325
21.5 - 46.5	10	0.0750	0.0628	0.3369	0.0406	0.0603	0.07798	0.5030
10.0 - 21.5	11	0.1262	0.1089	0.5737	0.0745	0.1055	0.13521	0.8366
4.65 - 10.0	12	0.1693	0.1493	0.8785	0.1082	0.1460	0.19399	1.3009
2.15 - 4.65	13	0.2355	0.2058	1.637	0.1512	0.2010	0.30128	2.440
1.00 - 2.15	14	0.3998	0.3358	3.429	0.2280	0.3225	0.54554	4.982
Fission fragment yields (x 100) U-233			$0.0^4$99	$0.0^3$33	$0.0^3$90	$0.0^2$68		$0.0^2$23
U-235			$0.0^4$15	$0.0^3$20	$0.0^3$35	0.015		$0.0^2$12
Pu-239			$0.0^3$12	$0.0^3$25	$0.0^3$62	$0.0^2$31		$0.0^2$14

Energies of groups, keV	i	Elements $_{34}Se^{74}$	Se^{76}	Se^{77}	Se^{78}	Se^{80}	Se^{82}	Se
Capture cross-section								
6500-10500	I	0.00164	0.00230	0.00297	0.00256	0.00019	0.00069	0.00121
4000 - 6500	2	0.00570	0.00818	0.00815	0.00956	0.00074	0.00290	0.00429
2500 - 4000	3	0.0121	0.0184	0.0179	0.0270	0.00213	0.00714	0.01119
1400 - 2500	4	0.0136	0.0181	0.0279	0.0306	0.00368	0.00810	0.01364
800 - 1400	5	0.0155	0.0200	0.0333	0.0301	0.00388	0.00869	0.01427
400 - 800	6	0.0399	0.0430	0.0584	0.0646	0.01173	0.0238	0.03186
200 - 400	7	0.0505	0.0633	0.1578	0.0765	0.01458	0.0295	0.04609
100 - 200	8	0.0578	0.0721	0.2856	0.0871	0.01790	0.0342	0.06120
46.5 - 100	9	0.0759	0.0956	0.3869	0.1162	0.0214	0.0420	0.08046
21.5 - 46.5	10	0.1236	0.1525	0.5522	0.1813	0.0323	0.0679	0.12166
10.0 - 21.5	11	0.1911	0.2276	0.8720	0.2638	0.0604	0.1177	0.19124
4.65 - 10.0	12	0.2483	0.2947	1.339	0.3426	0.0910	0.1617	0.27099
2.15 - 4.65	13	0.3639	0.4463	2.491	0.5347	0.1308	0.2228	0.44360
1.00 - 2.15	14	0.6764	0.8578	5.044	1.053	0.1905	0.3621	0.84134
Fission fragment yields (x 100) U-233				0.031	0.10	0.28	0.70	
U-235				0.0111	0.029	0.11	0.35	
Pu-239				0.01	0.025	0.07	0.17	

i	$_{35}Br^{79}$	Br^{81}	Br	$_{36}Kr^{78}$	Kr^{80}	Kr^{82}	Kr^{83}	Kr^{84}	Kr^{86}
I	0.00285	0.00047	0.00167	0.00452	0.00318	0.00206	0.00081	0.00026	0.00047
2	0.00831	0.00159	0.00498	0.0154	0.0116	0.00819	0.00220	0.00092	0.00118
3	0.0185	0.00392	0.01129	0.0315	0.0273	0.0258	0.00537	0.00329	0.00155
4	0.0306	0.00932	0.02007	0.0334	0.0267	0.03942	0.0168	0.00486	0.00138
5	0.0455	0.0238	0.03476	0.0314	0.0316	0.04292	0.0664	0.00787	0.00327
6	0.0823	0.0488	0.06572	0.0522	0.0775	0.0811	0.1453	0.0139	0.00446
7	0.2102	0.0895	0.15048	0.1034	0.0918	0.0822	0.1806	0.0139	0.00417
8	0.3769	0.1419	0.26062	0.1225	0.1066	0.0939	0.2681	0.0172	0.00517
9	0.5211	0.2071	0.36273	0.1664	0.1437	0.1251	0.3978	0.0207	0.00682
10	0.7793	0.3304	0.55718	0.2479	0.2189	0.1941	0.6409	0.0307	0.00886
11	1.308	0.5368	0.92656	0.3482	0.3115	0.2810	1.116	0.0576	0.0152
12	1.692	0.8078	1.2545	0.4638	0.4089	0.3655	1.969	0.0877	0.0254
13	2.673	1.470	2.0780	0.7740	0.6618	0.5743	3.649	0.1275	0.0458
14	4.617	2.087	3.3649	1.585	1.333	1.135	7.147	0.1844	0.0718
U-233	0,19	0.46			$0.0^{3}39$		1.07	1.79	3.01
U-235	0,055	0.14			$0.0^{4}10$	$0.0^{4}41$	0.50	0.94	1.81
Pu-239	0,04					0.0036		0.47	0.76

i	Kr	$_{37}Rb^{85}$	Rb^{87}	Rb	$_{38}Sr^{84}$	Sr^{86}	Sr^{87}
I	0.000650	0.00110	0.00030	0.00088	0.00440	0.00083	0.00056
2	0.00224	0.00267	0.00073	0.00213	0.0164	0.00275	0.00055
3	0.00647	0.00563	0.00135	0.00444	0.0436	0.00754	0.00113
4	0.01022	0.0124	0.00227	0.00958	0.0709	0.0157	0.00337
5	0.01850	0.0307	0.00275	0.02292	0.0769	0.0338	0.0143
6	0.03678	0.0493	0.00529	0.03704	0.1270	0.0331	0.0243
7	0.04144	0.0720	0.00849	0.05431	0.1240	0.0548	0.0319
8	0.05535	0.1122	0.0117	0.08424	0.1470	0.0404	0.0469
9	0.07721	0.1727	0.0162	0.12911	0.1984	0.0502	0.0706
10	0.12131	0.2872	0.0271	0.21476	0.2894	0.0816	0.1270
11	0.20507	0.4754	0.0536	0.35793	0.4038	0.1381	0.2283
12	0.33486	0.6306	0.0757	0.47606	0.5443	0.1865	0.3381
13	0.58609	0.9056	0.0959	0.68024	0.9265	0.2584	0.5698
14	1.1099	1.212	0.2073	0.93234	1.910	0.4325	1.141
U-233		2.37					4.47
U-235		1.38				$0.0^{4}24$	4.50
Pu-239		0.539					0.92

i	$^{88}_{38}Sr$	Sr	$^{89}_{39}Y$ [1]	$^{90}_{40}Zr$	^{9I}Zr	^{92}Zr	^{94}Zr	^{96}Zr
I	0.00240	0.002I3	0.00038	0.00I08	0.00037	0.00065	0.00024	Q000I9
2	0.00538	0.00484	0.00I45	0.00302	0.00083	0.00222	0.00095	0.00080
3	0.0II3	0.0I040	0.0034I	0.00570	0.00503	0.00434	0.00276	0.00296
4	0.0I96	0.0I836	0.004I9	0.0I43	0.0I64	0.00545	0.00472	0.006I8
5	0.0I69	0.0I872	0.007I6	0.0I0I	0.0I75	0.0I25	0.0I06	0.0I08
6	0.0I26	0.0I608	0.00882	0.0080I	0.0I88	0.0I72	0.0I52	0.0I50
7	0.0I2I	0.0I635	0.009I5	0.00772	0.022I	0.0I67	0.0I44	0.0I38
8	0.0I5I	0.02057	0.0I20	0.00986	0.03I0	0.0204	0.0I78	0.0I67
9	0.0I82	0.02604	0.0I56	0.0I24	0.0449	0.0243	0.02I3	0.0I99
I0	0.0260	0.04005	0.0237	0.0I67	0.0799	0.0360	0.0307	0.028I
II	0.0487	0.072II	0.0452	0.0308	0.I49I	0.0667	0.0572	0.0522
I2	0.0759	0.I0784	0.07I6	0.0499	0.2244	0.I040	0.0829	0.08II
I3	0.II36	0.I6446	0.II36	0.0397	0.3696	0.2625	0.0499	0.I200
I4	0.I624	0.26753	0.I789	0.0I70	0.3206	0.0793	0.0I99	0.I632
U-233	5,36		6.28	6.40	7.I7	6.63	6.70	
U-235	3,58		4.73	5.77	6.30	6.03	6.55	
Pu-239	I,39		I.74	2.05	2.6I	3.I4	4.48	

i	Zr [2]	$^{93}_{4I}Nb$ [3]	$^{92}_{42}Mo$	^{94}Mo	^{95}Mo	^{96}Mo	^{97}Mo	^{98}Mo	^{I00}Mo
I	0.00076	0.00052	0.00200	0.00II5	0.00I0I	0.00I33	0.00068	0.00I0I	0.00044
2	0.00222	0.00I47	0.005I0	0.00536	0.00278	0.00533	0.00I99	0.00445	0.002I8
3	0.00480	0.0032I	0.00979	0.0I32	0.006I5	0.0I42	0.0048I	0.0I30	0.00697
4	0.0III3	0.00844	0.0I57	0.0II6	0.0I69	0.0208	0.0II3	0.0260	0.0I39
5	0.0II45	0.04I8	0.0I93	0.0I80	0.0437	0.0232	0.056I	0.0266	0.0II6
6	0.0I224	0.0573	0.0I52	0.0300	0.0733	0.0469	0.0975	0.0493	0.0227
7	0.0I222	0.0702	0.0I52	0.0302	0.093I	0.0480	0.II53	0.0485	0.0345
8	0.0I56I	0.I0I2	0.0I90	0.0353	0.I380	0.0537	0.I59I	0.0535	0.0386
9	0.0I984	0.I527	0.0229	0.0425	0.2036	0.0662	0.2329	0.0652	0.0456
I0	0.02985	0.2604	0.0338	0.0673	0.3333	0.I063	0.3759	0.I040	0.07II
II	0.05542	0.4963	0.063I	0.II79	0.5477	0.I735	0.6I49	0.I705	0.I236
I2	0.08537	0.8I98	0.0957	0.I639	0.8I85	0.2296	0.9235	0.2268	0.I7I7
I3	0.II894	I.344	0.I364	0.2I98	I.3I3	0.27II	I.605	0.3II3	0.2702
I4	0.06635	I.892	0.I899	0.323I	I.853	0.I925	2.066	0.36I6	0.4642
U-233		7.02			6.02	$0.0^{2}65$	5.8	5.25	4.49
U-235		6.6I			6.55	$0.0^{3}59$	6.33	5.93	6.58
Pu-239		3.97			5.03	$0.0^{2}36$	5.65	5.89	7.I0

i	4 / Mo	96 ^{44}Ru	98 Ru	99 Ru	100 Ru	101 Ru	102 Ru	104 Ru	Ru
I	0.00II5	0.0I30	0.00226	0.00I53	0.00I7I	0.00I50	0.00467	0.00079	0.00513
2	0.00407	0.0394	0.0090I	0.00458	0.0076I	0.005I0	0.0222	0.00423	0.01259
3	0.0I028	0.0820	0.0235	0.0I20	0.0224	0.0I30	0.0654	0.0I43	0.01387
4	0.0I82I	0.0805	0.0300	0.0257	0.0277	0.0305	0.0893	0.0245	0.04968
5	0.028I3	0.0894	0.0292	0.04I3	0.0290	0.0642	0.08I2	0.0224	0.05514
6	0.04750	0.I330	0.0623	0.0893	0.0559	0.I229	0.I043	0.0240	0.0854I
7	0.05344	0.I280	0.0732	0.I883	0.0808	0.2646	0.I635	0.070	0.I5224
8	0.0682I	0.I477	0.08I7	0.2986	0.0894	0.42I3	0.I848	0.0783	0.20358
9	0.09228	0.I964	0.I042	0.4566	0.II45	0.6036	0.24I5	0.0977	0.28255
I0	0.I4843	0.2893	0.I660	0.6976	0.I796	0.9013	0.3442	0.I542	0.42I42
II	0.24587	0.4043	0.2508	I.I49	0.268I	I.493	0.4767	0.2370	0.65607
I2	0.354I7	0.5387	0.3246	I.780	0.3465	2.3I9	0.6433	0.3073	0.96I53
I3	0.544I2	0.897I	0.4820	3.298	0.5202	4.206	I.096	0.4470	I.6898
I4	0.70807	I.558	0.7752	5.539	0.8453	8.040	I.9I6	0.8226	3.0393
U-233						3.38	2.59	I.08	
U-235						5.03	4.I8	I.8I	
Pu-239						5.9I	5.99	5.93	

i	103 ^{45}Rh	102 ^{46}Pd	104 Pd	105 Pd	106 Pd	108 Pd	110 Pd	Pd
I	0.002I2	0.00387	0.00227	0.00I73	0.00I42	0.00085	0.00086	0.00I36
2	0.00829	0.0I67	0.0II2	0.00623	0.00749	0.00474	0.00473	0.00652
3	0.02I7	0.0490	0.0352	0.0I69	0.0250	0.0I66	0.0I60	0.02065
4	0.0453	0.0770	0.0623	0.04I0	0,0387	0.0285	0.0258	0.03726
5	0.0747	0.0672	0.0602	0.0808	0.045I	0.029I	0.0:I9	0.04735
6	0.I308	0.I092	0.0997	0.I8I3	0.0792	0.0432	0.0262	0.08765
7	0.2805	0.I43I	0.I309	0.4262	0.II0I	0.0873	0.0730	0.I7264
8	0.4I88	0.I638	0.I474	0.6I69	0.I2I2	0.0947	**0.0797**	0.:2333
9	0.5643	0.2I63	0.I932	0.83I6	0.I565	0.II95	0.0985	0.29526
I0	0.7932	0.3I50	0.2859	I.223	0.2378	0.I86I	0.I548	0.44042
II	I.254	0.4390	0.40I4	2.030	0.34I3	0.2779	0.2390	0.69860
I2	I.873	0.5865	0.5:94	3.I26	0.4433	0.3588	0.3I03	I.0I82
I3	2.74I	0.9836	0.8674	5.490	0.6966	0.536I	0.4486	I.72I8
I4	3.098	2.007	I.75I	8.936	I.373	I.0I5	0.8I90	2.9520
U-233	I,75			0.98	0.269	0.07	0.03	
U-235	2,9	0.0^{6}5I		0.90	0.385	0.07	0.0I8	
Pu-239	5,79			5.47	7.8I	2.60	0.55	

i	$^{107}_{47}Ag$	^{109}Ag	Ag	$^{106}_{48}Cd$	^{108}Cd	^{110}Cd	^{111}Cd	^{112}Cd	^{113}Cd
I	0.00I29	0.00I59	0.00I44	0.0I93	0.0035I	0.00223	0.00I09	0.00II6	0.00093
2	0.00555	0.00698	0.00625	0.08I9	0.0I84	0.0I23	0.00290	0.00626	0.00329
3	0.035I	0.0559	0.04522	0.2300	0.0604	0.0422	0.00865	0.0223	0.0I25
4	0.0694	0.I000	0.08429	0.3027	0.I38I	0.I082	0.023I	0.0527	0.0423
5	0.I047	0.I230	0.II360	0.2942	0.I322	0.I073	0.0459	0.0560	0.0872
6	0.I577	0.I840	0.I7049	0.4086	0.20I5	0.I673	0.09I7	0.I026	0.I5I2
7	0.3090	0.3490	0.32846	0.4308	0.2I42	0.I754	0.205I	0.II40	0.26I5
8	0.4472	0.492I	0.46904	0.5I09	0.2486	0.I989	0.3238	0.I247	0.3378
9	0.5925	0.6445	0.6I780	0.6282	0.3235	0.2594	0.4283	0.I599	0.4447
I0	0.8284	0.8978	0.86216	0.8I67	0.4448	0.3687	0.6086	0.2423	0.6297
II	I.I4I	I.425	I.2785	I.236	0.6I80	0.5I05	0.9354	0.3488	0.9682
I2	I.445	2.I78	I.80I6	I.876	0.8622	0.6903	I.377	0.4524	I.474
I3	2.0I4	3.767	2.867I	3.257	I.366	I.I00	2.037	0.6725	2.749
I4	3.390	5.447	4.3904	3.958	I.660	I.280	2.660	0.822I	3.800
U-233	0,I2	0.04					0.02		
U-235	0,I7	0.03				0.0621	0.0I3		0.0I
Pu-239	3,60	I.I3				0.74			0.065

i	^{114}Cd	^{116}Cd	Cd	$^{113}_{49}In$	^{115}In	In	$^{112}_{50}Sn$	^{114}Sn
I	0.00209	0.00045	0.00I7I	0.00046	0.00034	0.00035	0.00387	0.00I42
2	0.0II7	0.002II	0.008500	0.00I36	0.00I29	0.00I29	0.0I78	0.006I3
3	0.0507	0.00777	0.03I78	0.00420	0.00397	0.00398	0.0544	0.025I
4	0.0678	0.0I78	0.06003	0.0I47	0.0804	0.07762	0.0725	0.0778
5	0.0778	0.0I74	0.07I83	0.2I78	0.2464	0.245I9	0.062I	0.0989
6	0.I227	0.0329	0.I2030	0.273I	0.2538	0.25462	0.0979	0.0839
7	0.I5I6	0.0490	0.I6I97	0.3I84	0.2389	0.24226	0.I570	0.08I4
8	0.I664	0.05400	0.I9787	0.4388	0.3259	0.33068	0.I780	0.0900
9	0.2I45	0.0640	0.25699	0.6I29	0.4834	0.48888	0.233I	0.II33
I0	0.3I3I	0.0997	0.37055	0.9I92	0.7492	0.75639	0.3378	0.I779
II	0.437I	0.I669	0.54443	I.5I3	I.076	I.0947	0.4700	0.2698
I2	0.5770	0.2252	0.76473	2.030	I.347	I.376I	0.6276	0.349I
I3	0.9074	0.3056	I.23I5	2.542	I.660	I.697I	I.05I	0.5I44
I4	I.I50	0.3578	I.5833	2.760	I.848	I.8864	2.I40	0.9598
U-233	0.02	0.0I						
U-235	0.0II	0.0II		0.0I				
Pu-239	0.04	0.037		0.065				

Elements /	II5 Sn 50	II6 Sn	II7 Sn	II8 Sn	II9 Sn	I20 Sn	I22 Sn	I24 Sn
I	0.00072	0.00082	0.00I47	0.00050	0.00093	0.00029	0.00030	0.00022	0.00060
2	0.00I4I	0.00374	0.00363	0.00I88	0.00262	0.00I23	0.00III	0.00082	0.00220
3	0.00387	0.0270	0.00969	0.00626	0.00713	0.005I6	0.00427	0.00267	0.00945
4	0.00937	0.05I9	0.0280	0.0245	0.0I78	0.0I4I	0.0II8	0.00538	0.02367
5	0.0I73	0.0694	0.056I	0.0402	0.0407	0.0272	0.0238	0.0I26	0.0394I
6	0.0600	0.0577	0.08I5	0.034I	0.052I	0.0285	0.0207	0.0I56	0.03838
7	0.0955	0.0552	0.I086	0.03I8	0.0597	0.02I3	0.0I85	0.0I38	0.03990
8	0.II47	0.06I4	0.I893	0.0368	0.0842	0.0253	0.022I	0.0I66	0.052I7
9	0.I542	0.0743	0.279I	0.0433	0.I383	0.0300	0.0263	0.0202	0.06978
I0	0.242I	0.II72	0.4I30	0.0652	0.292I	0.0426	0.0365	0.0269	0.III23
II	0.3748	0.I9I4	0.6237	0.II56	0.5I38	0.0778	0.0667	0.0487	0.I855I
I2	0.52I2	0.2542	0.8987	0.I647	0.7278	0.II7I	0.I024	0.0773	0.26428
I3	0.8690	0.3547	I.596	0.2279	I.263	0.I689	0.I5I2	0.I203	0.42067
I4	I.I75	0.6089	3.26I	0.3495	2.576	0.2449	0.2I68	0.I7I7	0.77023
U-233	0.02		0.0I	0.02	0.02	0.02	0.03	0.05	
U-235	0.0II		0.0II	0.0II	0.0II	0.0II	0.0I3	0.0I7	
Pu-239	0.04I		0.036	0.035	0.036	0.037	0.035	0.056	

i	5I I2I Sb	I23 Sb	Sb	52 I20 Te	I22 Te	I23 Te	I24 Te	I25 Te
I	0.00082	0.00040	0.00064	0.00I44	0.00II6	0.00I57	0.00069	0.00I04
2	0.00305	0.00065	0.00202	0.00741	0.0066I	0.00536	0.00306	0.00220
3	0.00909	0.00I92	0.00603	0.0269	0.0243	0.0I60	0.0II5	0.0066I
4	0.040I	0.0I30	0.0285I	0.06I4	0.0528	0.0423	0.0203	0.0I77
5	0.0946	0.0740	0.08579	0.06I2	0.0549	0.0770	0.0258	0.0273
6	0.II28	0.0855	0.I0II3	0.I0I5	0.0935	0.I22I	0.0590	0.0495
7	0.I490	0.I038	0.I2965	0.I3II	0.I220	0.2269	0.0692	0.0832
8	0.2374	0.I577	0.20333	0.I439	0.I334	0.3920	0.0758	0.I244
9	0.3909	0.2366	0.32492	0.I847	0.I702	0.5484	0.092I	0.2I4I
I0	0.7I25	0.387I	0.57339	0.2765	0.2574	0.7682	0.I444	0.4255
II	0.9992	0.5570	0.8I0I6	0.3929	0.3698	I.I90	0.2290	0.6633
I2	I.230	0.6828	0.99579	0.5II9	0.4795	I.794	0.2999	0.93I3
I3	I.796	I.049	I.4764	0.8I38	0.7494	3.243	0.3306	I.306
I4	2.662	I.763	2.2773	I.497	I.380	5.950	0.3874	I.946
U-233	0,02	0.04						0.I52
U-235	0,0I2	0.0I4					0.03I04	0.046
Pu-239		0.04					0.088	0.07I

i	$^{126}_{52}Te$	^{128}Te	^{130}Te	^{132}Te	$^{127}_{53}I$	$^{124}_{54}Xe$	^{126}Xe	^{128}Xe
I	0.00033	0.00020	0.00027	0.00036	0.00078	0.00259	0.00177	0.00133
2	0.00152	0.00042	0.00024	0.00101	0.00968	0.00144	0.00932	0.00716
3	0.00569	0.00153	0.00075	0.00356	0.0299	0.0517	0.0342	0.0237
4	0.0140	0.00415	0.00215	0.00857	0.0560	0.1006	0.0618	0.0427
5	0.0148	0.00516	0.00372	0.01086	0.0779	0.0934	0.0523	0.0411
6	0.0336	0.0137	0.00725	0.02277	0.1233	0.0927	0.0641	0.0582
7	0.0368	0.0130	0.00666	0.02741	0.2021	0.1891	0.1364	0.1130
8	0.0421	0.0156	0.00779	0.03453	0.3324	0.2323	0.1613	0.1229
9	0.0493	0.0192	0.0102	0.04718	0.5019	0.3007	0.2071	0.1547
10	0.0742	0.0254	0.0132	0.07617	0.7874	0.4222	0.3065	0.2364
11	0.1336	0.0533	0.0256	0.12749	1.214	0.5834	0.4319	0.3455
12	0.1622	0.0697	0.0416	0.17363	1.650	0.7939	0.5654	0.4462
13	0.1726	0.0630	0.0289	0.21617	2.388	1.364	0.9111	0.6807
14	0.2416	0.0967	0.0597	0.33746	3.322	2.788	1.817	1.310
U-233	0,26	1.05	2.33		0.61			
U-235	0,032	0.50	2.0		0.25			
Pu-239	0,16	0.74	2.7		0.55			0.845

i	$^{129}_{54}Xe$	^{130}Xe	^{131}Xe	^{132}Xe	^{134}Xe	^{136}Xe		$^{133}_{55}Cs$
I	0.00129	0.00116	0.00187	0.00101	0.00042	0.00019	0.00115	0.00102
2	0.00406	0.00579	0.00250	0.00372	0.00207	0.00074	0.00328	0.00273
3	0.01206	0.0254	0.00726	0.0138	0.00702	0.00205	0.01093	0.00823
4	0.03202	0.0461	0.0183	0.0233	0.0142	0.00487	0.02337	0.0217
5	0.06794	0.0381	0.0352	0.0244	0.0202	0.00719	0.03719	0.0440
6	0.08812	0.0638	0.0651	0.0513	0.0332	0.00550	0.05869	0.1113
7	0.1183	0.0902	0.1159	0.0566	0.0304	0.00484	0.08072	0.1772
8	0.1771	0.0978	0.2070	0.0629	0.0356	0.00532	0.11848	0.2788
9	0.3023	0.1205	0.3118	0.0747	0.0418	0.00698	0.17938	0.4428
10	0.5658	0.1870	0.4884	0.1157	0.0610	0.00927	0.30419	0.6896
11	0.8629	0.2847	0.7833	0.1915	0.1091	0.0141	0.47738	1.117
12	1.269	0.3683	1.170	0.2568	0.1585	0.0229	0.69557	1.698
13	2.282	0.5380	2.116	0.3555	0.2217	0.0430	1.2113	2.939
14	4.588	0.9934	4.296	0.5967	0.3318	0.0726	2.3946	4.304
U-233			3.55	5	6.1	6.68		5.88
U-235	$0,0^{3}41$		2.84	4.24	7.62	6.47		7.48
Pu-239			3.78	5.26	7.47	6.63		6.91

i	$_{56}Ba^{130}$	Ba^{132}	Ba^{134}	Ba^{135}	Ba^{136}	Ba^{137}	Ba^{138}	Ba
I	0.00336	0.00207	0.00174	0.00303	0.00066	0.00036	0.000II	0.00042
2	0.0I75	0.0I03	0.00675	0.00227	0.00273	0.00079	0.00040	0.00093
3	0.0576	0.04I6	0.0235	0.00642	0.00929	0.00257	0.00I08	0.00288
4	0.0800	0.0525	0.0368	0.0I68	0.0I4I	0.00760	0.003I7	0.00636
5	0.07I8	0.0597	0.0407	0.0349	0.0I85	0.0I89	0.00456	0.0I027
6	0.09I0	0.0822	0.0826	0.0670	0.0422	0.0290	0.003I7	0.0I544
7	0.I865	0.I442	0.0958	0.I225	0.0393	0.0346	0.00289	0.0I978
8	0.2270	0.I584	0.I046	0.I7I9	0.0453	0.0457	0.003I4	0.02520
9	0.2930	0.2024	0.I296	0.2436	0.0533	0.0626	0.00412	0.03388
I0	0.4I45	0.30I2	0.2007	0.389I	0.080I	0.1064	0.00586	0.05371
II	0.5728	0.4268	0.3029	0.6278	0.I397	0.I926	0.00832	0.08837
I2	0.7735	0.5565	0.39I5	0.9249	0.I962	0.2854	0.0I29	0.I2862
I3	I.3I6	0.887I	0.5765	I.648	0.2703	0.4589	0.0253	0.2I594
I4	2.678	I.798	I.074	3.366	0.42I5	0.8589	0.047I	0.4I6I2
-				I0.2	0.I2	6.98	7.I	
-		0.0^{6}I5		I2.9	0.0059	6.63	6.68	
-				20.9	0.083	6.56	6.3I	

i	$_{57}La^{138}$	La^{139}	La	$_{58}Ce^{136}$	Ce^{138}	Ce^{140}	Ce^{142}	Ce
I	0.00025	0.000I4	0.000I4	0.003II	0.00I09	0.00072	0.00043	0.000695
2	0.00032	0.00043	0.00043	0.0I25	0.00463	0.00277	0.00215	0.00172
3	0.00075	0.00I94	0.00I94	0.0354	0.0I57	0.0I06	0.00603	0.0I038
4	0.00I90	0.00640	0.00640	0.0492	0.0325	0.0248	0.0I49	0.02377
5	0.00531	0.0I05	0.0I049	0.0478	0.0348	0.0236	0.0II9	0.02228
6	0.03I9	0.00932	0.00934	0.0433	0.0626	0.0I57	0.0147	0.0I687
7	0.II39	0.0I06	0.0I069	0.0649	0.0609	0.0I36	0.0260	0.0I519
8	0.I597	0.0I62	0.0I633	0.I415	0.0684	0.0I59	0.0296	0.0I779
9	0.2349	0.0238	0.02399	0.2I44	0.08I9	0.0I96	0.0345	0.0178
I0	0.3899	0.0400	0.0403I	0.3I77	0.I272	0.0255	0.0477	0.02878
II	0.644I	0.0790	0.07950	0.4485	0.2085	0.0449	0.0858	0.05062
I2	0.9540	0.I282	0.I2893	0.5862	0.2779	0.0720	0.I29I	0.07983
I3	I.703	0.2I48	0.2I6I2	0.9406	0.3862	0.I452	0.I864	0.I2535
I4	3.482	0.37II	0.37387	I.869	0.6567	0.I657	0.2697	0.I8I73
U-233		I2.I5		U-233		6.62	6.35	
U-235		I2.94		U-235		6.30	5.88	
Pu-239		5.87		Pu-239		5.60	5.0I	

t	$^{141}_{59}Pr$	$^{142}_{60}Nd$	^{143}Nd	^{144}Nd	^{145}Nd	^{146}Nd	^{148}Nd	^{150}Nd
1	0.00038	0.00087	0.00076	0.00079	0.00057	0.00069	0.00050	0.00083	0.00076
2	0.00134	0.00347	0.00255	0.00402	0.00110	0.00330	0.00245	0.00502	0.00329
3	0.0107	0.00964	0.00662	0.0141	0.00341	0.0132	0.0115	0.0236	0.01106
4	0.0207	0.0321	0.0185	0.0262	0.0118	0.0313	0.0323	0.0584	0.02868
5	0.0202	0.0331	0.0508	0.0242	0.0378	0.0312	0.0316	0.0632	0.03480
6	0.0192	0.0228	0.0952	0.0508	0.0694	0.0382	0.0293	0.0609	0.04740
7	0.0264	0.0202	0.1051	0.0479	0.0798	0.0727	0.0792	0.0741	0.05757
8	0.0512	0.0239	0.1408	0.0532	0.1269	0.0773	0.0934	0.1610	0.07460
9	0.0802	0.0286	0.2030	0.0617	0.2380	0.0904	0.1098	0.2474	0.10279
10	0.1385	0.0389	0.3372	0.0922	0.4158	0.1379	0.1675	0.3574	0.16170
11	0.2426	0.0702	0.5598	0.1582	0.6800	0.2231	0.2622	0.4986	0.26314
12	0.3445	0.1082	0.8224	0.2192	1.005	0.2956	0.3421	0.6521	0.37287
13	0.4988	0.1611	1.446	0.3012	1.792	0.4113	0.4844	1.052	0.59909
14	0.6867	0.2303	2.949	0.4772	3.649	0.7028	0.8575	2.091	1.1283
~233	6.10		5.57	4.48	3.22	2.41	1.25		
~235	2.14		5.90	5.43	3.88	2.95	1.7		
~239			4.57	3.77	3.13	2.60	1.67		

t	$^{144}_{62}Sm$	^{147}Sm	^{148}Sm	^{149}Sm	^{150}Sm	^{152}Sm	^{154}Sm	^{151}Eu
1	0.00373	0.00164	0.00120	0.00217	0.00138	0.00128	0.00107	0.00149	0.00371
2	0.01454	0.00527	0.0063	0.00584	0.00905	0.00815	0.00733	0.00728	0.0204
3	0.0387	0.0164	0.0255	0.0201	0.0384	0.0375	0.0338	0.02985	0.0680
4	0.0908	0.1592	0.0728	0.0661	0.0820	0.1041	0.0776	0.09556	0.2130
5	0.0947	0.3601	0.0682	0.1579	0.0997	0.0990	0.0875	0.14035	0.4468
6	0.0647	0.3417	0.1014	0.3310	0.1010	0.0951	0.0766	0.16094	0.6349
7	0.0599	0.3988	0.1279	0.5782	0.1966	0.1152	0.0875	0.22154	0.9579
8	0.0667	0.6024	0.1345	0.8330	0.2288	0.2367	0.1719	0.34212	1.358
9	0.0789	0.8477	0.1647	1.125	0.2860	0.3570	0.3092	0.49073	1.745
10	0.1210	1.236	0.2486	1.710	0.4059	0.4919	0.4441	0.71629	2.535
11	0.2004	1.998	0.3645	2.901	0.5604	0.6748	0.6108	1.1093	4.05
12	0.2691	3.032	0.4695	4.302	0.7424	0.9153	0.8162	1.5971	6.805
13	0.3719	5.098	0.7071	7.135	1.128	1.564	1.367	2.6940	9.019
14	0.6217	9.991	1.345	12.23	2.467	3.166	2.756	5.0183	14.49
~233		1.78		0.710	0.471	0.201	0.024		0.348
~235		2.13		1.02	0.637	0.231	0.056		0.456
~239		1.99		1.32	0.91	0.62	0.29		0.8

i	$^{153}_{63}Eu$	$^{155}_{63}Eu$	$^{152}_{64}Gd$	^{154}Gd	^{155}Gd	^{156}Gd	^{157}Gd	^{158}Gd	^{160}Gd
I	0.00252	0.00309	0.00300	0,00478	0.00248	0.00184	0.00115	0.00151	0.00095
2	0.0143	0.0171	0.0199	0.0352	0.00850	0.0132	0.00396	0.0115	0.00712
3	0.0516	0.05943	0.0811	0.1417	0.0324	0.0590	0.0153	0.0504	0.0318
4	0.1748	0.19305	0.1494	0.2590	0.0946	0.1237	0.0491	0.0900	0.0730
5	0.3740	0.40878	0.1812	0.2864	0.1590	0.1546	0.1219	0.1118	0.0735
6	0.5256	0.57781	0.2091	0.2922	0.2203	0.1326	0.1541	0.0972	0.0563
7	0.7169	0.83203	0.3463	0.3481	0.3966	0.1538	0.2338	0.1106	0.0650
8	1.307	1.3309	0.4098	0.5719	0.8574	0.2908	0.4717	0.2095	0.1211
9	1.959	1.8567	0.5086	0.7654	1.469	0.4694	0.8105	0.3711	0.2374
10	2.703	2.6222	0.6699	0.9789	2.169	0.6303	1.393	0.5211	0.3646
11	4.125	4.0676	0.9350	1.437	3.402	0.8729	2.229	0.7149	0.5099
12	5.837	6.2992	1.329	2.131	4.947	1.225	3.354	0.9736	0.6654
13	9.055	9.0374	2.360	3.807	7.968	2.158	5.768	1.670	1.067
14	14.53	14.510	4.744	7.334	13.26	4.350	10.35	3.376	2.112
U-233	0,112				0.03	0.013		0.0024	0.0003
U-235	0,148				0.03	0.025		0.0031	0.00033
Pu-239	0,2				0.23	0.062	0.076	0.042	0.0098

i	$^{156}_{64}Gd$	$^{159}_{65}Tb$	$^{156}_{66}Dy$	^{158}Dy	^{160}Dy	^{161}Dy	^{162}Dy	^{163}Dy
I	0.00162	0.00157	0.00410	0.00396	0.00241	0.00219	0.00172	0.00089
2	0.00979	0.00932	0.0294	0.0298	0.0183	0.0114	0.00879	0.00352
3	0.04196	0.0441	0.1262	0.1265	0.0798	0.0412	0.0391	0.0134
4	0.09276	0.1558	0.2469	0.2388	0.1653	0.1151	0.0763	0.0418
5	0.12460	0.2620	0.2993	0.2906	0.1766	0.3127	0.0760	0.1023
6	0.12697	0.3674	0.3024	0.2680	0.1524	0.3272	0.0688	0.1470
7	0.17603	0.5794	0.3721	0.3148	0.1764	0.4836	0.0830	0.3060
8	0.34370	0.9033	0.6011	0.5433	0.3261	0.8072	0.1578	0.5735
9	0.60131	1.327	0.7904	0.7547	0.5193	1.311	0.2953	0.9145
10	0.89869	1.986	1.012	0.9680	0.6914	2.237	0.4514	1.557
11	1.3516	3.134	1.492	1.415	0.9637	3.624	0.5956	2.172
12	1.9517	4.596	2.217	2.093	1.367	5.226	0.7698	3.469
13	3.2552	7.511	3.952	3.736	2.421	8.317	1.307	5.642
14	5.9351	12.69	7.575	7.212	4.854	13.67	2.620	10.18
U-233						0.00012		
U-235						0.00009		
Pu-239		0.021				0.0039	0.0024	0.001

Elements	66 Dy	I64 Dy	Fission fragments U-233	U-235	Pu-239
I	0.00094	0.00I27	0,002	0,002	0,002
2	0.00687	0.00767	0,005	0,006	0,007
3	0.0306	0.03I74	0,0I5	0,0I7	0,023
4	0.0497	0.07I68	0,035	0,038	0,049
5	0.0502	0.I226I	0,059	0,065	0,077
6	0.0498	0.I3398	0,092	0,I03	0,I27
7	0.0558	0.20839	0,I29	0,I48	0,202
8	0.I068	0.37428	0,I84	0,2I0	0,283
9	0.2I55	0.6250I	0,26I	0,297	0,39I
I0	0.3382	0.98392	0,408	0,46I	0,59I
II	0.4778	I.5375	0,677	0,760	0,958
I2	0.6I93	2.2I36	I.02	I.I4	I.42
I3	0.9745	3.6482	I.69	I.90	2.35
I4	I.909	6.45I6	2.82	3.20	3.89
Pu -239	$0.0^{3}37$				

NOTES ON TABLE 2

1. The cross-sections presented in Ref. [5] differ somewhat from the results obtained during the present work. The existing experimental results do not allow us to judge which of the cross-sections mentioned are to be preferred. It is clear only that in the region around 1 keV the calculation for ^{89}Y must be carried out on the basis of the parameters of the individual levels, and not on the basis of the average resonance parameters, as has been done in Ref. [2].

2. After compilation of the BNAB-64 system of constants [1] experimental data were published for Zr in the energy region below 30 keV [16]. Hence in groups (10-14) the capture cross-sections from that reference are to be preferred. Above 30 keV the agreement of the results is good, except for the fourth group where Benzi's calculation [2] shows a bump in the cross-section which is not in evidence in Ref. [1]. The high estimate of the BNAB-64 capture cross-sections in the first and second groups can be explained by the fact that in Ref. [1] the total capture cross-sections are given, including the contribution from (n,p) and (n,α) reactions.

3. For ^{93}Nb the agreement with Ref. [1] for the group-averaged constants in the region above 10 keV is satisfactory. In the region below 10 keV the calculated curve for the capture cross-section from Ref. [1] fits the experimental points of Ref. [17] exactly, but the cross-sections in Ref. [1] itself are overestimated. However, it should be borne in mind that in this energy region the experimental data may be low owing to resonance self-shielding in the sample.

4. For Mo agreement with Ref. [1] is good, with the exception of the first few groups (where in BNAB-64 [1] the contribution of (n,p) and (n,α) reactions is taken into account).

5,6. The capture cross-sections in the BNAB-64 energy breakdown [1] for Eu and Gd are given in report KFK-770 [18]. For these elements the calculated curve in the region below 30 keV is low (cf Table 1) compared with the experimental data in Refs [19] and [20], as can be seen from the figures in Ref. [3]. In Ref. [18] the cross-section is close to the experimental data.

7. The sum of the fission fragment yields is two.

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