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Systematic calculation of total atomic energies of ground state configurations[☆]

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Abstract

We present a systematic study of atomic binding energies, in the Dirac–Fock approximation, for the Lithium (3 electrons) to the Dubnium (105 electrons) isoelectronic series. In each series we have considered all atomic numbers from the one corresponding to the neutral atom up to $Z = 118$. We have obtained the ground state configurations for several heavy ions with charge larger than one.

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1. Introduction

The determination of accurate values of atomic masses is an important field that is being pursued in several places in the world using Penning traps (e.g., MIT [1,2], SMILETRAP in Stockholm [3,4], ISOLTRAP at CERN [5]). At SMILETRAP the atomic masses are obtained from highly charged ions, and accurate binding energies are required to obtain the atomic mass, which is always given for a neutral atom. New projects are being built, like HITTRAP at GSI, which will require binding energies for heavier and more highly charged ions.

The need for accurate atomic masses occurs in many fields of physics, from nuclear physics to fundamental constants determination. Accurate masses of stable isotopes can be used to calibrate mass spectra of short-lived isotopes obtained in storage rings [6,7] or Penning traps [5]. They can provide Q values for double- β decay studies [3] for tests of the Standard Model.

One very important application of accurate atomic masses is for the determination of the fine structure constant α from the measurement of the recoil energy of atoms absorbing monochromatic photons [8–10]. This determination is based on the following expression (see, e.g., [11])

$$\alpha^2 = \frac{2R_\infty}{c} \frac{\hbar}{m_e} = \frac{2R_\infty}{c} \frac{\hbar}{m_X} \frac{A_r(X)}{A_r(e)},$$

where R_∞ is the Rydberg constant, A_r is the relative mass in unified atomic mass units (see, e.g., [11]) and m_X is the mass of the atom X. The Rydberg constant is known with a relative uncertainty of 7.6×10^{-12} , the velocity of light is, by definition, 299792458 m/s, and the relative uncertainty in $A_r(e)$ is now 7.3×10^{-10} [12]. In order to obtain an accurate value of the fine structure constant, one needs an accurate value of the \hbar/m_X ratio and of $A_r(X)$. Penning-trap mass measurements with accuracy in the 10^{-9} – 10^{-11} range have now been performed for atoms (Rb, Cs) suitable for optical measurements [1,4] of the photon recoil energy.

When using highly charged ions in a Penning trap to measure a mass (mostly to increase the signal-to-noise ratio), one has to obtain the atomic mass from the ion mass. One has to account for the mass $qA_r(e)$ of the q electrons removed and for their atomic binding energy E_B . Thus, the mass of atom X (in unified atomic mass units) becomes

$$A_r(X) = A_r(X^{q+}) + qA_r(e) - \frac{E_B}{c^2}.$$

The influence of the binding energy uncertainties in the mass determination depends on the atom studied and increases with the value of Z . For example, in the Cs mass determination, an uncertainty of about 10 eV in the calculated K-, Ar-, and Cl-like Cs ions binding energies [13] provides an uncertainty of the order of 10^{-11} in the mass determination [4,13]. For the current level of precision obtained in Penning traps, an uncertainty of the order of few tens of eV in the binding energy determination of heavy elements, that is, a relative uncertainty of less than 0.1%, is more than sufficient.

We present in this paper a systematic calculation of the total atomic binding energies, in the Dirac–Fock (DF) approximation, for the lithium (3 electrons) to dubnium (105 electrons) isoelectronic series. In each series we have considered all atomic numbers from the one corresponding to the neutral atom up to $Z = 118$. As the ground state configurations were unknown for some medium-charged heavy ions, we have performed systematic calculations for different outer-shell structure and total angular momentum, to find the ground state. One has to remember that this is the ground state in the DF sense, without correlation included, and it does not necessarily coincide with the experimental ground state, at least when close to neutrality. When the ground configuration was known from the experiment (see, e.g., [14–16] and references therein) or relativistic coupled-cluster calculations [17,18], we used the known configuration, even if it did not coincide with the ground configuration in the DF sense.

Our aim is to provide a complete set of results that can be used to provide the difference in binding energy between two arbitrary charges. As a special case, if the charge differs by one unit, one obtains the ionization energy of the valence electron of an atom or ion.

The paper is organized as follows. In the next section we summarize the principle of the calculations, with a brief description of the DF method. The results of the calculation are presented in the section that then follows.

All numerical results presented here are evaluated with values of the fundamental constants from the 1998 adjustment [11].

2. Method

In order to get a correct relationship between many-body methods and quantum electrodynamics (QED) [19–22], one should start from the no-pair Hamiltonian

$$\mathcal{H}^{\text{no pair}} = \sum_{i=1}^N \mathcal{H}_D(r_i) + \sum_{i < j} \mathcal{V}(|\mathbf{r}_i - \mathbf{r}_j|), \quad (1)$$

where \mathcal{H}_D is the one electron Dirac operator and \mathcal{V} is an operator representing the electron–electron interaction of order one in α , properly set up between projection operators to avoid coupling positive and negative energy states. Since we deal only with DF calculations, such subtleties are not needed here. We can thus use the usual electron–electron interaction in the Coulomb gauge which reads

$$V_{ij} = \frac{1}{r_{ij}} \quad (2a)$$

$$- \frac{\boldsymbol{\alpha}_i \cdot \boldsymbol{\alpha}_j}{r_{ij}} \quad (2b)$$

$$- \frac{\boldsymbol{\alpha}_i \cdot \boldsymbol{\alpha}_j}{r_{ij}} \left[\cos \left(\frac{\omega_{ij} r_{ij}}{c} \right) - 1 \right] \\ + c^2 (\boldsymbol{\alpha}_i \cdot \nabla_i) (\boldsymbol{\alpha}_j \cdot \nabla_j) \frac{\cos \left(\frac{\omega_{ij} r_{ij}}{c} \right) - 1}{\omega_{ij}^2 r_{ij}}, \quad (2c)$$

where $r_{ij} = |\mathbf{r}_i - \mathbf{r}_j|$ is the inter-electronic distance, ω_{ij} is the energy of the photon exchanged between the two electrons, $\boldsymbol{\alpha}_i$ are the Dirac matrices and $c = 1/\alpha$ is the speed of light. We use the Coulomb gauge as it has been demonstrated that it provides energies free from spurious contributions at the ladder approximation level and must be used in many-body atomic structure calculations [23–25].

The term (2a) represents the Coulomb interaction, the term (2b) is the Gaunt (magnetic) interaction, and the last two terms (2c) stand for the retardation operator. In this expression the ∇ operators act only on r_{ij} and not on the following wavefunctions.

By a series expansion of the operators in expressions (2b) and (2c) in powers of $\omega_{ij} r_{ij}/c \ll 1$, one obtains the Breit interaction, which includes the leading retardation contribution of order $1/c^2$. The Breit interaction is, then, the sum of the Gaunt interaction (2b) and of the Breit retardation

$$B_{ij}^R = \frac{\boldsymbol{\alpha}_i \cdot \boldsymbol{\alpha}_j}{2r_{ij}} - \frac{(\boldsymbol{\alpha}_i \cdot r_{ij})(\boldsymbol{\alpha}_j \cdot r_{ij})}{2r_{ij}^3}. \quad (3)$$

In the many-body part of the calculation the electron–electron interaction is described by the sum of the Coulomb and the Breit interaction. Higher orders in $1/c$, coming from the difference between Eqs. (2c) and (3) are treated here only as a first-order perturbation.

In order to know the order of magnitude of the error produced by this approximation we refer to the two-electron systems. The difference between a full QED treatment of the electron-electron interaction and that of the Breit approximation was studied within second order perturbation theory for He-like systems [26]; it is shown that this difference varies from 10^{-5} eV, for $Z = 2$, to a few tenths of an eV for $Z = 80$. This corre-

sponds to a relative difference of 2×10^{-6} and 6×10^{-2} , respectively.

A suitable method for this calculation is the DF approximation. This is the relativistic equivalent of the Hartree–Fock approximation. In this model, the electrons are treated in the independent-particle approximation, and their wavefunctions are evaluated in the Coulomb field of the nucleus and the spherically averaged field from the electrons. It is usual to consider first the Coulomb field from the electrons and then to generalize the DF approximation to include also the Breit interaction as a first-order interaction. Yet there are no fundamental justifications to treat both parts of the electron–electron interaction on a different footing. Such an approximation is certainly sufficient for the outer shell of neutral atoms. However, when it comes to correlation energy for highly charged ions of high- Z , the contribution of the Breit interaction can be much larger than that of the Coulomb interaction (see, e.g., [13,19,27] and references therein). In that case, the Coulomb–Breit correlation energy must be added, to be consistent, to a DF calculation performed with both Coulomb and Breit interactions self-consistently. This is what has been carried out in the present work.

All calculations are done for finite nuclei. For $Z \leq 42$ we use uniformly charged spheres. For higher atomic numbers we use a Fermi distribution with a thickness parameter of 2.3 fm. The nuclear radii are the ones that have been used for recent calculations of inner-shell binding energies [28–30]. Most of them come from [31]. For atomic numbers $Z \geq 90$ we use experimental values when available [32,33], or the Johnson and Soff extrapolation formula corrected for nuclear deformation (an increase of roughly 0.11 fm [30]).

Finally, from a full QED treatment, one also obtains the radiative corrections (important for the innermost shells) to the electron–nucleus interaction (self-energy and vacuum polarization). The one-electron self-energy is evaluated using the one-electron values of Mohr et al. [34–36]. The self-energy screening is treated with the Welton method developed in [27,29,30,37]. This method yields results in close agreement (better than 5%) with ab initio methods based on QED [38–40], without a great amount of effort. The vacuum polarization is evaluated as described in [41]. The Uehling contribution is evaluated to all orders by being included in the self-consistent-field (SCF). The Wichmann and Kroll and Källén and Sabry contributions are included perturbatively. All three contributions are evaluated using numerical procedures from [42,43].

In the DF method the atomic wavefunction and energy are obtained by solving

$$\mathcal{H}^{\text{no pair}} \Psi_{\Pi,J,M}(\dots, \mathbf{r}_i, \dots) = E_{\Pi,J,M} \Psi_{\Pi,J,M}(\dots, \mathbf{r}_i, \dots), \quad (4)$$

with a set of trial functions, which are eigenfunctions of the parity Π , the total angular momentum J^2 with eigenvalue J , and its projection on the z axis J_z with eigenvalue M .

The total wavefunction $\Psi_{\Pi,J,M}(\dots, \mathbf{r}_i, \dots)$ is then constructed as a superposition of configuration state functions (CSF)

$$|\Psi_{\Pi,J,M}\rangle = \sum_v c_v |v\Pi JM\rangle. \quad (5)$$

Each CSF is also an eigenfunction of Π , J^2 , and J_z . The label v stands for all other numbers (principal quantum number, ...) necessary to define unambiguously the CSF. The c_v are called the mixing coefficients and are obtained by diagonalization of the Hamiltonian matrix coming from the minimization of the energy in Eq. (4) with respect to the c_v . In the present work, since we remain at the DF level, those coefficients will only account for the intermediate coupling.

Each CSF is a linear combination of Slater determinants

$$|\Psi_{\Pi,J,M}\rangle = \sum_i d_i \begin{vmatrix} \Phi_1^i(r_1) & \dots & \Phi_N^i(r_1) \\ \vdots & \ddots & \vdots \\ \Phi_1^i(r_N) & \dots & \Phi_N^i(r_N) \end{vmatrix}, \quad (6)$$

where the Φ are the one-electron wavefunctions and the coefficients d_i are determined by requiring that the CSF is an eigenstate of J^2 and J_z . In the relativistic case, the one-electron wavefunctions are the Dirac four-component spinors

$$\Phi_{n\kappa\mu}(r) = \frac{1}{r} \begin{bmatrix} P_{n\kappa}(r)\chi_{\kappa\mu}(\theta, \phi) \\ iQ_{n\kappa}(r)\chi_{-\kappa\mu}(\theta, \phi) \end{bmatrix}, \quad (7)$$

where $\chi_{\kappa\mu}(\theta, \phi)$ is a two-component Pauli spherical spinor [44] and $P_{n\kappa}(r)$ and $Q_{n\kappa}(r)$ are the large and the small radial components of the wavefunction, respectively. The functions $P_{n\kappa}(r)$ and $Q_{n\kappa}(r)$ are the solutions of coupled integro-differential equations obtained by minimizing the energy as defined in Eq. (4) with respect to each radial wavefunction (for more details, see [44–46]).

3. Results and discussion

The known ground state configurations used in these calculations were obtained from [16]. The search for the ground configuration state started with the neutral element associated with each isoelectronic series, followed by the neighboring element (in atomic number). As expected, there is a stabilization of the ground state configuration into the expected relativistic configuration after an increase of the atomic number by one (at low Z) to a few units.

The results obtained are displayed in Table 1. The structure of the ground configurations previously un-

known are presented in boldface. To identify energy levels of a given ion configuration, we list the occupied shells and the total angular momentum J .

We have checked the ground configuration of singly ionized atoms from [47] and they agree with the ones obtained in this work, except in following cases: Lu, Th, Pa, Np, and Cm. The corresponding energy differences run from -0.37 to -0.83 eV, our results being the lowest ones. Resolving these discrepancies would require elaborate multiconfiguration DF calculations, beyond the scope of this work. They have negligible effects on the total binding energy which is of interest for applications to atomic mass measurements.

As an example, all the contributions considered in the calculation of the atomic binding energy are listed in Table 2, for the lithium- and sodium-like ground state configurations and $Z = 15$, $Z = 55$, and $Z = 95$.

From Tables 3–105 we present the total binding energies for each isoelectronic series. It is important when using these tables to be able to estimate the uncertainty associated with the approximations made in this work. These approximations concern many-body corrections (correlation) and QED corrections. Errors in the nuclear charge distribution mean spherical radius can be important at high- Z . Most QED corrections, and nuclear size uncertainty, will be negligibly small if one uses the table to evaluate binding energies between ions with complete inner shells (mostly 1s and 2s, and also 2p_{1/2} for high- Z). It is only if such shells have different numbers of electrons between the two charge states that missing screening corrections and two-body QED corrections, as well as nuclear size problems, will introduce errors in the order of a few eV (see [26,48] and the discussion on uncertainty in [28,30]). The many-body contribution, however, will be important in all cases. From [13] it can be clearly seen that one should count roughly -1 eV/electron of missing correlation energy. In order to check the accuracy of our calculation by other means, we present in Graph 1 a comparison between experiment [16] and our calculation for the ionization energy of the valence electron of neutral atoms. This energy is obtained as the difference between the total binding energy of the neutral atom and the one of the singly-charged ion. One can see that the agreement is on the order of a couple of eV at worse. The standard deviation of the calculation compared to experimental data is 1.2 eV. Obviously the outer shell is the most difficult one to reproduce in a calculation such as the one presented here. We used the recently released NIST database [47] to check our calculations against the experimental value of the ionization energy of singly charged ions. The experimental and theoretical energies are compared in Graph 2. The standard deviation is 1.27 eV.

4. Conclusions

We report a systematic study of atomic binding energies, in the DF approximation, for the lithium (3 electrons) to dubnium (105 electrons) isoelectronic series. In this work a fully relativistic DF approach was used, allowing for a more precise calculation by the introduction of the Breit term in a self-consistent approach, and other QED terms. We have also obtained some previously unknown ground configurations needed in these calculations.

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References

- [1] M.P. Bradley, J.V. Porto, S. Rainville, J.K. Thompson, D.E. Pritchard, Phys. Rev. Lett. 83 (1999) 4510.
- [2] F. DiFilippo, V. Natarajan, K.R. Boyce, D.E. Pritchard, Phys. Rev. Lett. 73 (1994) 1481.
- [3] G. Douisset, T. Fritioff, C. Carlberg, I. Bergström, M. Bjorkhage, Phys. Rev. Lett. 86 (2001) 4259.
- [4] C. Carlberg, T. Fritioff, I. Bergström, Phys. Rev. Lett. 83 (1999) 4506.
- [5] D. Beck, F. Ames, G. Audi, G. Bollen, F. Herfurth, H.-J. Kluge, A. Kohl, M. König, D. Lunney, I. Martel, et al., Eur. Phys. J. A 8 (2000) 307.
- [6] H. Geissel, G. Münzenberg, Eur. Phys. J. A 13 (2002) 247.
- [7] H. Geissel, F. Attallah, K. Beckert, F. Bosch, M. Falch, B. Franzke, M. Hausmann, T. Kerscher, O. Klepper, H.J. Kluge, et al., Nucl. Phys. A 26 (2001) 115.
- [8] D. Weiss, B. Young, S. Chu, Phys. Rev. Lett. 70 (1993) 2706.
- [9] J.M. Hensley, A. Wicht, B.C. Young, S. Chu, in: E. Arimondo, P. De Natale, M. Inguscio, (Ed.), ICAP 2000, 17th International Conference in Atomic Physics, (AIP, Florence, Italy, 2001.) vol. 551, AIP Conference Proceedings, pp. 43–57.
- [10] C. Schwob, L. Masson, B. Gremaud, S. Guellati, F. Nez, L. Julien, F. Biraben, J. Phys. IV (Proceedings), 10 (2000) 153.
- [11] P.J. Mohr, B.N. Taylor, Rev. Mod. Phys. 72 (2000) 351.
- [12] T. Beier, H. Häffner, N. Hermanspahn, S.G. Karshenboim, H. Kluge, W. Quint, S. Stahl, J. Verdú, G. Werth, Phys. Rev. Lett. 88 (2002) 011603.
- [13] G.C. Rodrigues, M.A. Ourdane, J. Bieroń, P. Indelicato, E. Lindroth, Phys. Rev. A 63 (2001) 012510.
- [14] C. Moore, Atomic Energy Levels. Vol. Circ. 467, Vol. II, reprinted as Natl. Stand. Ref. Data Ser. Natl. Bur. Stand. (U.S.) 35 (1971).
- [15] C. Moore, Atomic Energy Levels. Vol. Circ. 467, Vol. III, reprinted as Natl. Stand. Ref. Data Ser., Natl. Bur. Stand. (U.S.) 35 (1971).
- [16] W.C. Martin, A. Musgrove, S. Kotochigova, Ground levels and ionization energies for the neutral atoms national institute of standards and technology, 1999, Available from <<http://physics.nist.gov/ionenergy>>.
- [17] E. Eliav, U. Kaldor, Y. Ishikawa, Phys. Rev. Lett. 74 (1995) 1079.
- [18] E. Eliav, U. Kaldor, Y. Ishikawa, Phys. Rev. A 52 (1995) 291.
- [19] P. Indelicato, Phys. Rev. A 51 (1995) 1132.
- [20] G.E. Brown, D.E. Ravenhall, Proc. R. Soc. Lon. Ser. A 208 (1951) 552.
- [21] J. Sucher, Phys. Rev. A 22 (1980) 348.
- [22] M.H. Mittleman, Phys. Rev. A 24 (1981) 1167.
- [23] O. Gorceix, P. Indelicato, Phys. Rev. A 37 (1988) 1087.
- [24] E. Lindroth, A.-M. Mårtensson-Pendrill, Phys. Rev. A 39 (1989) 3794.
- [25] I. Lindgren, J. Phys. B: At. Mol. Phys. 23 (1990) 1085.
- [26] I. Lindgren, H. Persson, S. Salomonson, L. Labzowsky, Phys. Rev. A 51 (1995) 1167.
- [27] P. Indelicato, J.P. Desclaux, Phys. Rev. A 42 (1990) 5139.
- [28] R. Deslattes, E. Kessler Jr., P. Indelicato, L. de Billy, E. Lindroth, J. Anton, Rev. Mod. Phys. 75 (2003) 35.
- [29] P. Indelicato, S. Boucard, E. Lindroth, Eur. Phys. J. D 3 (1998) 29.
- [30] P. Indelicato, E. Lindroth, Phys. Rev. A 46 (1992) 2426.
- [31] W.R. Johnson, G. Soff, At. Data Nucl. Data Tables 33 (1985) 405.
- [32] J.D. Zumbro, R.A. Naumann, M.V. Hoehn, W. Reuter, E.B. Shera, C.E. Bemis Jr., Y. Tanaka, Phys. Lett. 167B (1986) 383.
- [33] J.D. Zumbro, E.B. Shera, Y. Tanaka, C.E. Bemis Jr., R.A. Naumann, M.V. Hoehn, W. Reuter, R.M. Steffen, Phys. Rev. Lett. 53 (1984) 1888.
- [34] P.J. Mohr, Phys. Rev. A 26 (1982) 2338.
- [35] P.J. Mohr, Y.-K. Kim, Phys. Rev. A 45 (1992) 2727.
- [36] P.J. Mohr, Phys. Rev. A 46 (1992) 4421.
- [37] P. Indelicato, O. Gorceix, J.P. Desclaux, J. Phys. B 20 (1987) 651.
- [38] P. Indelicato, P.J. Mohr, Theor. Chim. Acta 80 (1991) 207.
- [39] S.A. Blundell, Phys. Rev. A 46 (1992) 3762.
- [40] S.A. Blundell, Phys. Scr. T 46 (1993) 144.
- [41] S. Boucard, P. Indelicato, Eur. Phys. J. D 8 (2000) 59.
- [42] S. Klarsfeld, Phys. Lett. 30A (1969) 382.
- [43] L.W. Fullerton, G. Rinker, Phys. Rev. A 13 (1976) 1283.
- [44] I.P. Grant, Adv. Phys. 19 (1970) 747.
- [45] J.P. Desclaux, Comp. Phys. Commun. 9 (1975) 1.
- [46] J.P. Desclaux, in: E. Clementi (Ed.), Relativistic multiconfiguration dirac-fock package, vol. A, STEF, Cagliari, 1993.
- [47] J. Sansonetti, W. Martin, S. Young, Handbook of basic atomic spectroscopic data 2003, (National Institute of Standards and Technology) Available from <<http://physics.nist.gov/handbook>>.
- [48] S.A. Blundell, P.J. Mohr, W.R. Johnson, J. Sapirstein, Phys. Rev. A 48 (1993) 2615.

Explanation of Tables

Table 1. List of configurations

This table lists the configurations of the fundamental states and correspondent total angular momentum quantum number J . The previously unknown configurations are typeset in boldface.

Series	Denotes the isoelectronic series
Z	The atomic number of the ground state; it runs from the atomic number of the element that labels the series up to 118
Configuration	Configuration of the ground state
J	Ground state total angular momentum

Table 2. Contributions to the atomic binding energy

This table lists the contributions to the atomic binding energy for the lithium- and sodium-like isoelectronic sequence and for $Z = 15$, $Z = 55$, and $Z = 95$. The energies are given in eV.

Tables 3–105. Total binding energies of all isoelectronic series from Li-like to Db-like

These tables list the total binding energy (DF) of the isoelectronic series of lithium through the isoelectronic series of dubnium. The ground state configurations used for each atomic number are reported in Table 1. The energies are given in eV.

Explanation of Graphs

Graph 1. Comparison between experiment and theory for neutral atoms

The figure presents a comparison between experiment [16] and theory (this work) for the ionization energy of the valence electron of neutral atoms. This energy is obtained as the difference between the total binding energy of the neutral atom and the one of the singly charged ion.

Graph 2. Comparison between experiment and theory for singly ionized atoms

The figure presents a comparison between experiment [47] and theory (this work) for the ionization energy of the valence electron of singly ionized atoms.

Table 1

List of configurations. See page 124 for Explanation of Tables

Series	Z	Configuration	J
Li	3–118	1s ² 2s	1/2
Be	4–118	1s ² 2s ²	0
B	5–118	1s ² 2s ² 2p	1/2
C	6–118	1s ² 2s ² 2p ²	0
N	7–118	1s ² 2s ² 2p ³	3/2
O	8–118	1s ² 2s ² 2p ⁴	2
F	9–118	1s ² 2s ² 2p ⁵	3/2
Ne	10–118	1s ² 2s ² 2p ⁶	0
Na	11–118	[Ne]3s	1/2
Mg	12–118	[Ne]3s ²	0
Al	13–118	[Ne]3s ² 3p	1/2
Si	14–118	[Ne]3s ² 3p ²	0
P	15–118	[Ne]3s ² 3p ³	3/2
S	16–118	[Ne]3s ² 3p ⁴	2
Cl	17–118	[Ne]3s ² 3p ⁵	3/2
Ar	18–118	[Ne]3s ² 3p ⁶	0
K	19–20	[Ar]4s	1/2
	21–118	[Ar]3d	3/2
Ca	20	[Ar]4s ²	0
	21	[Ar]3d4s	1
	22–118	[Ar]3d ²	2
Sc	21	[Ar]3d4s ²	3/2
	22	[Ar]3d ² 4s	3/2
	23–118	[Ar]3d ³	3/2
Ti	22	[Ar]3d ² 4s ²	2
	23–118	[Ar]3d ⁴	0
V	23	[Ar]3d ³ 4s ²	3/2
	24–118	[Ar]3d ⁵	5/2
Cr	24–25	[Ar]3d ⁵ 4s	3
	26–118	[Ar]3d ⁶	4
Mn	25	[Ar]3d ⁵ 4s ²	5/2
	26	[Ar]3d ⁶ 4s	9/2
	27–118	[Ar]3d ⁷	9/2
Fe	26	[Ar]3d ⁶ 4s ²	4
	27–118	[Ar]3d ⁸	4
Co	27	[Ar]3d ⁷ 4s ²	9/2
	28–118	[Ar]3d ⁹	5/2
Ni	28	[Ar]3d ⁸ 4s ²	4
	29–118	[Ar]3d ¹⁰	0
Cu	29–118	[Ar]3d ¹⁰ 4s	1/2
Zn	30–118	[Ar]3d ¹⁰ 4s ²	0
Ga	31–118	[Ar]3d ¹⁰ 4s ² 4p	1/2
Ge	32–118	[Ar]3d ¹⁰ 4s ² 4p ²	0
As	33–118	[Ar]3d ¹⁰ 4s ² 4p ³	3/2
Se	34–118	[Ar]3d ¹⁰ 4s ² 4p ⁴	2
Br	35–118	[Ar]3d ¹⁰ 4s ² 4p ⁵	3/2
Kr	36–118	[Ar]3d ¹⁰ 4s ² 4p ⁶	0
Rb	37–38	[Kr]5s	1/2
	39–118	[Kr]4d	3/2
Sr	38–39	[Kr]5s ²	0
	40–118	[Kr]4d ²	2
Y	39	[Kr]4d5s ²	3/2
	40	[Kr]4d ² 5s	3/2
	41–118	[Kr]4d ³	3/2
Zr	40	[Kr]4d ² 5s ²	2
	41–118	[Kr]4d ⁴	0
Nb	41	[Kr]4d ⁴ 5s	1/2
	42–118	[Kr]4d ⁵	5/2
Mo	42–43	[Kr]4d ⁵ 5s	3
	44–118	[Kr]4d ⁶	4
Tc	43	[Kr]4d ⁵ 5s ²	5/2
	44–118	[Kr]4d ⁷	9/2

Table 1 (continued)

Series	Z	Configuration	J
Ru	44	[Kr]4d ⁷ 5s	5
	45–118	[Kr]4d ⁸	4
Rh	45	[Kr]4d ⁸ 5s	9/2
	46–118	[Kr]4d ⁹	5/2
Pd	46–118	[Kr]4d ¹⁰	0
Ag	47–118	[Kr]4d ¹⁰ 5s	1/2
Cd	48–118	[Kr]4d ¹⁰ 5s ²	0
In	49–118	[Kr]4d ¹⁰ 5s ² 5p	1/2
Sn	50–118	[Kr]4d ¹⁰ 5s ² 5p ²	0
Sb	51–118	[Kr]4d ¹⁰ 5s ² 5p ³	3/2
Te	52–118	[Kr]4d ¹⁰ 5s ² 5p ⁴	2
I	53–118	[Kr]4d ¹⁰ 5s ² 5p ⁵	3/2
Xe	54–118	[Kr]4d ¹⁰ 5s ² 5p ⁶	0
Cs	55–56	[Xe]6s	1/2
	57	[Xe]5d	3/2
	58–118	[Xe]4f	5/2
Ba	56	[Xe]6s ²	0
	57	[Xe]5d ²	2
	58–118	[Xe]4f ²	4
La	57	[Xe]5d6s ²	3/2
	58	[Xe]4f5d ²	7/2
	59–118	[Xe]4f ³	9/2
Ce	58	[Xe]4f5d6s ²	4
	59	[Xe]4f ³ 6s	4
	60–118	[Xe]4f ⁴	4
Pr	59	[Xe]4f ³ 6s ²	9/2
	60	[Xe]4f ⁴ 6s	7/2
	61–118	[Xe]4f ⁵	5/2
Nd	60	[Xe]4f ⁴ 6s ²	4
	61	[Xe]4f ⁵ 6s	2
	62–118	[Xe]4f ⁶	0
Pm	61	[Xe]4f ⁵ 6s ²	5/2
	62	[Xe]4f ⁶ 6s	1/2
	63–118	[Xe]4f ⁷	7/2
Sm	62	[Xe]4f ⁶ 6s ²	0
	63	[Xe]4f ⁷ 6s	4
	64	[Xe]4f ⁷ 5d	2
	65–118	[Xe]4f ⁸	6
Eu	63	[Xe]4f ⁷ 6s ²	7/2
	64	[Xe]4f ⁷ 5d6s	5/2
	65–118	[Xe]4f ⁹	15/2
Gd	64	[Xe]4f ⁷ 5d6s ²	2
	65	[Xe]4f ⁹ 6s	8
	66–118	[Xe]4f ¹⁰	8
Tb	65	[Xe]4f ⁹ 6s ²	15/2
	66	[Xe]4f ¹⁰ 6s	17/2
	67–118	[Xe]4f ¹¹	15/2
Dy	66	[Xe]4f ¹⁰ 6s ²	8
	67	[Xe]4f ¹¹ 6s	8
	68–118	[Xe]4f ¹²	6
Ho	67	[Xe]4f ¹¹ 6s ²	15/2
	68	[Xe]4f ¹² 6s	13/2
	69–118	[Xe]4f ¹³	7/2
Er	68	[Xe]4f ¹² 6s ²	6
	69	[Xe]4f ¹³ 6s	4
	70–118	[Xe]4f ¹⁴	0
Tm	69	[Xe]4f ¹³ 6s ²	7/2
	70–71	[Xe]4f ¹⁴ 6s	1/2
	72–118	[Xe]4f ¹⁴ 5d	3/2
Yb	70–71	[Xe]4f ¹⁴ 6s ²	0
	72–118	[Xe]4f ¹⁴ 5d ²	2
Lu	71	[Xe]4f ¹⁴ 5d6s ²	3/2
	72	[Xe]4f ¹⁴ 5d ² 6s	3/2
	73–118	[Xe]4f ¹⁴ 5d ³	3/2

Table 1 (continued)

Series	Z	Configuration	J
Hf	72	[Xe]4f ¹⁴ 5d ² 6s ²	2
	73	[Xe]4f ¹⁴ 5d ³ 6s	1
	74–118	[Xe]4f ¹⁴ 5d ⁴	0
Ta	73	[Xe]4f ¹⁴ 5d ³ 6s ²	3/2
	74	[Xe]4f ¹⁴ 5d ⁴ 6s	1/2
	75–118	[Xe]4f ¹⁴ 5d ⁵	5/2
W	74	[Xe]4f ¹⁴ 5d ⁴ 6s ²	0
	75–76	[Xe]4f ¹⁴ 5d ⁵ 6s	3
	77–118	[Xe]4f ¹⁴ 5d ⁶	4
Re	75	[Xe]4f ¹⁴ 5d ⁵ 6s ²	5/2
	76	[Xe]4f ¹⁴ 5d ⁶ 6s	9/2
	77–118	[Xe]4f ¹⁴ 5d ⁷	9/2
Os	76	[Xe]4f ¹⁴ 5d ⁶ 6s ²	4
	77	[Xe]4f ¹⁴ 5d ⁷ 6s	5
	78–118	[Xe]4f ¹⁴ 5d ⁸	4
Ir	77	[Xe]4f ¹⁴ 5d ⁷ 6s ²	9/2
	78–118	[Xe]4f ¹⁴ 5d ⁹	5/2
Pt	78	[Xe]4f ¹⁴ 5d ⁹ 6s	3
	79–118	[Xe]4f ¹⁴ 5d ¹⁰	0
Au	79–118	[Xe]4f ¹⁴ 5d ¹⁰ 6s	1/2
Hg	80–118	[Xe]4f ¹⁴ 5d ¹⁰ 6s ²	0
Tl	81–118	[Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p	1/2
Pb	82–118	[Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ²	0
Bi	83–118	[Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ³	3/2
Po	84–118	[Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁴	2
At	85–118	[Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁵	3/2
Rn	86–118	[Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁶	0
Fr	87–89	[Rn]7s	1/2
Ra	90–118	[Rn]5f	5/2
	88–89	[Rn]7s ²	0
	90	[Rn]6d ²	2
Ac	91–118	[Rn]5f ²	4
	89	[Rn]6d7s ²	3/2
	90	[Rn]6d ² 7s	3/2
Th	91	[Rn]5f ² 6d	11/2
	92–118	[Rn]5f ³	9/2
	90	[Rn]6d ² 7s ²	2
Pa	91	[Rn]5f ² 6d7s	5
	92	[Rn]5f ³ 6d	6
	93–118	[Rn]5f ⁴	4
U	91	[Rn]5f ² 6d7s ²	11/2
	92	[Rn]5f ³ 6d7s	11/2
	93	[Rn]5f ⁴ 6d	11/2
Np	94–118	[Rn]5f ⁵	5/2
	92	[Rn]5f ³ 6d7s ²	6
	93	[Rn]5f ⁴ 6d7s	5
Pu	94–118	[Rn]5f ⁶	2
	91	[Rn]5f ⁴ 6d7s ²	11/2
	92	[Rn]5f ³ 6d7s	11/2
Am	93	[Rn]5f ⁴ 6d7s	7/2
	94	[Rn]5f ⁵ 6d7s	7/2
	95–118	[Rn]5f ⁷	7/2
Cm	94	[Rn]5f ⁶ 7s ²	0
	95–96	[Rn]5f ⁷ 7s	4
	97–118	[Rn]5f ⁸	6
Bk	95	[Rn]5f ⁷ 7s ²	7/2
	96	[Rn]5f ⁷ 7s ²	7/2
	97	[Rn]5f ⁸ 7s	13/2
Cm	98–118	[Rn]5f ⁹	15/2
	96	[Rn]5f ⁷ 6d7s ²	2
	97	[Rn]5f ⁸ 6d7s	7
Bk	98–118	[Rn]5f ¹⁰	8
	97	[Rn]5f ⁹ 7s ²	15/2
	98	[Rn]5f ¹⁰ 7s	17/2
Bk	99–118	[Rn]5f ¹¹	3/2

Table 1 (continued)

Series	Z	Configuration	J
Cf	98	[Rn]5f ¹⁰ 7s ²	8
	99	[Rn]5f ¹¹ 7s	8
	100–118	[Rn]5f ¹²	6
Es	99	[Rn]5f ¹¹ 7s ²	15/2
	100	[Rn]5f ¹² 7s	11/2
	101–118	[Rn]5f ¹³	5/2
Fm	100	[Rn]5f ¹² 7s ²	6
	101	[Rn]5f ¹³ 7s	4
	102–118	[Rn]5f ¹⁴	0
Md	101	[Rn]5f ¹³ 7s ²	7/2
	102–104	[Rn]5f ¹⁴ 7s	1/2
	105–118	[Rn]5f ¹⁴ 6d	3/2
No	102	[Rn]5f ¹⁴ 7s ²	0
	103–104	[Rn]5f ¹⁴ 7s ²	0
	105–118	[Rn]5f ¹⁴ 6d ²	2
Lr	103	[Rn]5f ¹⁴ 7s ² 7p	1/2
	104	[Rn]5f ¹⁴ 6d7s ²	3/2
	105–118	[Rn]5f ¹⁴ 6d ² 7s	3/2
Rf	104	[Rn]5f ¹⁴ 6d ² 7s ²	2
	105	[Rn]5f ¹⁴ 6d ² 7s ²	2
	106	[Rn]5f ¹⁴ 6d ³ 7s	1
Db	107–118	[Rn]5f ¹⁴ 6d ⁴	0
	105	[Rn]5f ¹⁴ 6d ³ 7s ²	3/2
	106–108	[Rn]5f ¹⁴ 6d ⁴ 7s	1/2
Bk	109–118	[Rn] 5f ¹⁴ 6d ⁵	5/2

Table 2

Contributions to the atomic binding energy. See page 124 for Explanation of Tables

	Li-like			Na-like		
	Z = 15	Z = 55	Z = 95	Z = 15	Z = 55	Z = 95
Coulomb	-6499.45109	-95146.66693	-318513.67046	-9185.85558	-161082.83629	-546426.12378
Magnetic	1.25539	69.00372	410.88935	2.02637	149.22942	916.67705
Retardation (order ω^2)	-0.01184	-0.80210	-5.55971	-0.14047	-13.13618	-76.58117
Higher-order retardation ($> \omega^2$)	0.00007	0.05286	0.74574	-0.00134	-1.62014	-24.79203
Hydrogen-like self-energy	1.38144	116.90325	886.47547	1.50082	131.15597	1052.00780
Self-energy screening	-0.07804	-2.38385	-15.93257	-0.17581	-6.21323	-43.90981
Vacuum polarization (Uhlening) $\alpha(Z\alpha)$	-0.08355	-16.64162	-240.81792	-0.08463	-17.76168	-269.23974
Electronic correction to Uheling	0.00108	0.05401	0.45195	0.00205	0.10347	0.88072
Vacuum polarization $\alpha(Z\alpha)^3$	0.00019	0.38568	12.20380	0.00019	0.41266	13.74222
Vac. Pol. (Källén & Sabry) $\alpha^2(Z\alpha)$	-0.00068	-0.13158	-1.82646	-0.00069	-0.14045	-2.04309
Recoil	-0.00027	-0.01440	-0.08863	-0.00018	-0.01454	-0.09533
Total Energy	-6496.98732	-94980.24097	-317467.12945	-9182.72927	-160840.82098	-544859.47717

Table 3

Total binding energy (DF) of the isoelectronic series of lithium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
3	-202	27	-21773	51	-81045	75	-185013	99	-350696
4	-389	28	-23462	52	-84412	76	-190507	100	-359432
5	-636	29	-25215	53	-87857	77	-196109	101	-368343
6	-945	30	-27034	54	-91379	78	-201818	102	-377446
7	-1316	31	-28919	55	-94980	79	-207635	103	-386741
8	-1747	32	-30869	56	-98661	80	-213563	104	-396235
9	-2241	33	-32886	57	-102421	81	-219605	105	-405933
10	-2796	34	-34970	58	-106263	82	-225763	106	-415832
11	-3412	35	-37121	59	-110187	83	-232038	107	-425953
12	-4091	36	-39340	60	-114194	84	-238433	108	-436298
13	-4831	37	-41626	61	-118285	85	-244950	109	-446876
14	-5633	38	-43981	62	-122460	86	-251591	110	-457694
15	-6497	39	-46405	63	-126722	87	-258362	111	-468761
16	-7423	40	-48898	64	-131071	88	-265263	112	-480086
17	-8412	41	-51461	65	-135509	89	-272298	113	-491678
18	-9464	42	-54094	66	-140034	90	-279458	114	-503549
19	-10578	43	-56798	67	-144652	91	-286769	115	-515708
20	-11755	44	-59573	68	-149361	92	-294218	116	-528168
21	-12995	45	-62420	69	-154164	93	-301818	117	-540941
22	-14298	46	-65339	70	-159060	94	-309566	118	-554040
23	-15665	47	-68332	71	-164052	95	-317467		
24	-17096	48	-71398	72	-169142	96	-325526		
25	-18591	49	-74539	73	-174332	97	-333750		
26	-20150	50	-77754	74	-179621	98	-342135		

The ground state configurations used for each atomic number are reported in Table 1.

Table 4

Total binding energy (DF) of the isoelectronic series of beryllium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
4	-397	27	-23886	50	-85851	73	-193088	96	-361522
5	-660	28	-25750	51	-89500	74	-198969	97	-370702
6	-991	29	-27687	52	-93233	75	-204966	98	-380064
7	-1391	30	-29697	53	-97053	76	-211077	99	-389624
8	-1859	31	-31779	54	-100960	77	-217309	100	-399382
9	-2395	32	-33936	55	-104954	78	-223661	101	-409337
10	-2999	33	-36166	56	-109037	79	-230133	102	-419509
11	-3673	34	-38470	57	-113210	80	-236731	103	-429899
12	-4414	35	-40849	58	-117473	81	-243457	104	-440513
13	-5225	36	-43303	59	-121828	82	-250311	105	-451357
14	-6104	37	-45833	60	-126276	83	-257298	106	-462430
15	-7053	38	-48439	61	-130817	84	-264421	107	-473754
16	-8070	39	-51122	62	-135452	85	-271679	108	-485331
17	-9157	40	-53881	63	-140184	86	-279077	109	-497172
18	-10314	41	-56719	64	-145014	87	-286621	110	-509285
19	-11540	42	-59634	65	-149943	88	-294311	111	-521681
20	-12836	43	-62629	66	-154970	89	-302152	112	-534369
21	-14202	44	-65703	67	-160100	90	-310135	113	-547361
22	-15638	45	-68857	68	-165332	91	-318285	114	-560668
23	-17146	46	-72091	69	-170669	92	-326592	115	-574303
24	-18724	47	-75407	70	-176110	93	-335070	116	-588280
25	-20373	48	-78805	71	-181659	94	-343713	117	-602612
26	-22093	49	-82286	72	-187318	95	-352529	118	-617315

The ground state configurations used for each atomic number are reported in Table 1.

Table 5

Total binding energy (DF) of the isoelectronic series of boron (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
5	-668	28	-27883	51	-97640	74	-217798	97	-406854
6	-1015	29	-29997	52	-101732	75	-224389	98	-417180
7	-1438	30	-32191	53	-105920	76	-231107	99	-427725
8	-1936	31	-34465	54	-110203	77	-237957	100	-438491
9	-2509	32	-36820	55	-114583	78	-244941	101	-449478
10	-3157	33	-39257	56	-119060	79	-252058	102	-460707
11	-3881	34	-41775	57	-123636	80	-259314	103	-472178
12	-4681	35	-44376	58	-128313	81	-266712	104	-483900
13	-5555	36	-47059	59	-133090	82	-274252	105	-495880
14	-6506	37	-49826	60	-137970	83	-281939	106	-508116
15	-7533	38	-52676	61	-142953	84	-289776	107	-520633
16	-8635	39	-55610	62	-148040	85	-297764	108	-533435
17	-9814	40	-58630	63	-153234	86	-305906	109	-546533
18	-11070	41	-61735	64	-158535	87	-314211	110	-559936
19	-12402	42	-64926	65	-163946	88	-322677	111	-573656
20	-13811	43	-68204	66	-169465	89	-331311	112	-587707
21	-15297	44	-71570	67	-175098	90	-340103	113	-602099
22	-16860	45	-75024	68	-180843	91	-349081	114	-616848
23	-18501	46	-78566	69	-186705	92	-358233	115	-631968
24	-20221	47	-82198	70	-192682	93	-367574	116	-647474
25	-22018	48	-85921	71	-198777	94	-377099	117	-663383
26	-23894	49	-89735	72	-204995	95	-386816	118	-679713
27	-25849	50	-93641	73	-211335	96	-396731		

The ground state configurations used for each atomic number are reported in Table 1.

Table 6

Total binding energy (DF) of the isoelectronic series of carbon (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
6	-1026	29	-32180	52	-109972	75	-243393	98	-453645
7	-1467	30	-34553	53	-114521	76	-250708	99	-465163
8	-1990	31	-37013	54	-119174	77	-258169	100	-476924
9	-2596	32	-39562	55	-123933	78	-265777	101	-488929
10	-3283	33	-42199	56	-128799	79	-273530	102	-501201
11	-4053	34	-44926	57	-133772	80	-281436	103	-513739
12	-4906	35	-47743	58	-138855	81	-289496	104	-526554
13	-5840	36	-50649	59	-144049	82	-297714	105	-539654
14	-6857	37	-53647	60	-149354	83	-306092	106	-553038
15	-7957	38	-56736	61	-154772	84	-314634	107	-566732
16	-9140	39	-59917	62	-160304	85	-323342	108	-580741
17	-10406	40	-63190	63	-165952	86	-332220	109	-595077
18	-11756	41	-66558	64	-171718	87	-341275	110	-609752
19	-13189	42	-70019	65	-177604	88	-350507	111	-624778
20	-14706	43	-73574	66	-183609	89	-359924	112	-640171
21	-16307	44	-77226	67	-189737	90	-369515	113	-655944
22	-17992	45	-80973	68	-195989	91	-379310	114	-672113
23	-19762	46	-84818	69	-202368	92	-389295	115	-688694
24	-21617	47	-88760	70	-208873	93	-399488	116	-705706
25	-23557	48	-92802	71	-215508	94	-409884	117	-723168
26	-25584	49	-96942	72	-222276	95	-420491	118	-741099
27	-27696	50	-101184	73	-229179	96	-431316		
28	-29894	51	-105527	74	-236216	97	-442368		

The ground state configurations used for each atomic number are reported in Table 1.

Table 7

Total binding energy (DF) of the isoelectronic series of nitrogen (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
7		30	-36766	53	-122565	76	-268328	99	-496291
8	-2025	31	-39404	54	-127556	77	-276293	100	-508733
9	-2658	32	-42137	55	-132659	78	-284412	101	-521427
10	-3380	33	-44965	56	-137876	79	-292684	102	-534395
11	-4192	34	-47890	57	-143209	80	-301116	103	-547638
12	-5092	35	-50911	58	-148658	81	-309710	104	-561165
13	-6082	36	-54029	59	-154224	82	-318469	105	-574986
14	-7161	37	-57246	60	-159909	83	-327395	106	-589099
15	-8329	38	-60560	61	-165714	84	-336494	107	-603530
16	-9588	39	-63974	62	-171641	85	-345766	108	-618284
17	-10936	40	-67487	63	-177691	86	-355215	109	-633373
18	-12375	41	-71100	64	-183865	87	-364849	110	-648810
19	-13903	42	-74815	65	-190167	88	-374669	111	-664607
20	-15523	43	-78631	66	-196595	89	-384680	112	-680777
21	-17233	44	-82549	67	-203154	90	-394874	113	-697337
22	-19034	45	-86571	68	-209844	91	-405278	114	-714300
23	-20927	46	-90697	69	-216668	92	-415881	115	-731685
24	-22912	47	-94928	70	-223625	93	-426700	116	-749508
25	-24988	48	-99264	71	-230719	94	-437729	117	-767790
26	-27157	49	-103707	72	-237955	95	-448977	118	-786550
27	-29419	50	-108258	73	-245332	96	-460451		
28	-31774	51	-112917	74	-252850	97	-472160		
29	-34223	52	-117686	75	-260516	98	-484101		

The ground state configurations used for each atomic number are reported in Table 1.

Table 8

Total binding energy (DF) of the isoelectronic series of oxygen (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
8	-2037	31	-41659	54	-135700	77	-294065	100	-540067
9	-2691	32	-44573	55	-141143	78	-302689	101	-553444
10	-3442	33	-47588	56	-146707	79	-311475	102	-567102
11	-4289	34	-50706	57	-152393	80	-320428	103	-581044
12	-5231	35	-53928	58	-158203	81	-329551	104	-595278
13	-6270	36	-57254	59	-164137	82	-338845	105	-609814
14	-7406	37	-60685	60	-170197	83	-348315	106	-624650
15	-8637	38	-64221	61	-176385	84	-357965	107	-639812
16	-9966	39	-67863	62	-182701	85	-367796	108	-655306
17	-11391	40	-71611	63	-189148	86	-377811	109	-671143
18	-12913	41	-75466	64	-195726	87	-388019	110	-687335
19	-14532	42	-79429	65	-202439	88	-398420	111	-703896
20	-16249	43	-83501	66	-209285	89	-409020	112	-720839
21	-18064	44	-87683	67	-216270	90	-419811	113	-738179
22	-19976	45	-91974	68	-223392	91	-430820	114	-755931
23	-21987	46	-96377	69	-230656	92	-442035	115	-774113
24	-24097	47	-100891	70	-238060	93	-453474	116	-792743
25	-26306	48	-105518	71	-245609	94	-465131	117	-811838
26	-28614	49	-110258	72	-253306	95	-477015	118	-831421
27	-31022	50	-115114	73	-261153	96	-489132		
28	-33530	51	-120084	74	-269147	97	-501492		
29	-36139	52	-125171	75	-277297	98	-514093		
30	-38848	53	-130376	76	-285601	99	-526950		

The ground state configurations used for each atomic number are reported in Table 1.

Table 9

Total binding energy (DF) of the isoelectronic series of fluorine (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
9	-2707	31	-43785	53	-137939	75	-293708	97	-530322
10	-3481	32	-46873	54	-143589	76	-302497	98	-543575
11	-4359	33	-50070	55	-149367	77	-311454	99	-557093
12	-5339	34	-53377	56	-155272	78	-320579	100	-570879
13	-6423	35	-56794	57	-161307	79	-329872	101	-584932
14	-7609	36	-60322	58	-167472	80	-339341	102	-599275
15	-8899	37	-63962	59	-173769	81	-348986	103	-613909
16	-10293	38	-67713	60	-180199	82	-358810	104	-628844
17	-11790	39	-71578	61	-186763	83	-368818	105	-644088
18	-13391	40	-75556	62	-193463	84	-379013	106	-659641
19	-15096	41	-79648	63	-200301	85	-389396	107	-675528
20	-16905	42	-83855	64	-207278	86	-399972	108	-691754
21	-18819	43	-88177	65	-214396	87	-410748	109	-708332
22	-20838	44	-92616	66	-221655	88	-421724	110	-725273
23	-22963	45	-97171	67	-229060	89	-432908	111	-742591
24	-25192	46	-101845	68	-236609	90	-444289	112	-760300
25	-27528	47	-106638	69	-244307	91	-455896	113	-778413
26	-29969	48	-111550	70	-252153	92	-467718	114	-796948
27	-32518	49	-116582	71	-260151	93	-479770	115	-815920
28	-35173	50	-121737	72	-268305	94	-492049	116	-835348
29	-37936	51	-127013	73	-276614	95	-504562	117	-855251
30	-40806	52	-132414	74	-285080	96	-517316	118	-875649

The ground state configurations used for each atomic number are reported in Table 1.

Table 10

Total binding energy (DF) of the isoelectronic series of neon (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
10	-3501	32	-49050	54	-151249	76	-319053	98	-572600
11	-4404	33	-52424	55	-157356	77	-328498	99	-586773
12	-5418	34	-55914	56	-163598	78	-338118	100	-601222
13	-6541	35	-59522	57	-169976	79	-347914	101	-615946
14	-7774	36	-63247	58	-176492	80	-357892	102	-630968
15	-9118	37	-67091	59	-183147	81	-368055	103	-646290
16	-10572	38	-71054	60	-189941	82	-378404	104	-661919
17	-12137	39	-75136	61	-196878	83	-388945	105	-677866
18	-13812	40	-79339	62	-203957	84	-399679	106	-694130
19	-15598	41	-83662	63	-211181	85	-410610	107	-710735
20	-17495	42	-88108	64	-218551	86	-421741	108	-727689
21	-19504	43	-92676	65	-226069	87	-433079	109	-745002
22	-21624	44	-97367	66	-233736	88	-444626	110	-762686
23	-23857	45	-102182	67	-241555	89	-456387	111	-780756
24	-26202	46	-107122	68	-249527	90	-468354	112	-799224
25	-28659	47	-112188	69	-257654	91	-480554	113	-818105
26	-31230	48	-117381	70	-265937	92	-492976	114	-837416
27	-33914	49	-122701	71	-274379	93	-505637	115	-857173
28	-36712	50	-128149	72	-282983	94	-518532	116	-877394
29	-39624	51	-133727	73	-291751	95	-531669	117	-898098
30	-42650	52	-139436	74	-300683	96	-545055	118	-919305
31	-45792	53	-145276	75	-309784	97	-558699		

The ground state configurations used for each atomic number are reported in Table 1.

Table 11

Total binding energy (DF) of the isoelectronic series of sodium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
11	-4409	33	-53380	55	-160841	77	-336348	99	-601430
12	-5432	34	-56950	56	-167238	78	-346219	100	-616264
13	-6569	35	-60640	57	-173776	79	-356270	101	-631382
14	-7819	36	-64451	58	-180455	80	-366508	102	-646806
15	-9183	37	-68385	59	-187277	81	-376935	103	-662537
16	-10660	38	-72440	60	-194243	82	-387555	104	-678585
17	-12250	39	-76618	61	-201354	83	-398371	105	-694960
18	-13955	40	-80920	62	-208612	84	-409387	106	-711660
19	-15773	41	-85347	63	-216019	85	-420604	107	-728712
20	-17706	42	-89898	64	-223576	86	-432027	108	-746121
21	-19753	43	-94575	65	-231286	87	-443664	109	-763900
22	-21915	44	-99379	66	-239148	88	-455514	110	-782060
23	-24193	45	-104311	67	-247166	89	-467585	111	-800617
24	-26585	46	-109370	68	-255342	90	-479868	112	-819583
25	-29094	47	-114559	69	-263677	91	-492390	113	-838974
26	-31718	48	-119879	70	-272173	92	-505141	114	-858806
27	-34460	49	-125329	71	-280831	93	-518137	115	-879096
28	-37318	50	-130911	72	-289657	94	-531374	116	-899863
29	-40294	51	-136626	73	-298651	95	-544859	117	-921127
30	-43387	52	-142476	74	-307813	96	-558601	118	-942908
31	-46599	53	-148461	75	-317150	97	-572608		
32	-49930	54	-154582	76	-326659	98	-586879		

The ground state configurations used for each atomic number are reported in Table 1.

Table 12

Total binding energy (DF) of the isoelectronic series of magnesium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
12	-5439	34	-57934	56	-170784	78	-354176	100	-631104
13	-6587	35	-61706	57	-177480	79	-364480	101	-646612
14	-7851	36	-65601	58	-184320	80	-374975	102	-662434
15	-9233	37	-69622	59	-191307	81	-385665	103	-678572
16	-10731	38	-73768	60	-198441	82	-396553	104	-695035
17	-12345	39	-78040	61	-205725	83	-407642	105	-711834
18	-14077	40	-82440	62	-213160	84	-418937	106	-728967
19	-15926	41	-86967	63	-220748	85	-430438	107	-746462
20	-17892	42	-91622	64	-228490	86	-442150	108	-764323
21	-19976	43	-96407	65	-236389	87	-454082	109	-782564
22	-22178	44	-101321	66	-244444	88	-466234	110	-801197
23	-24498	45	-106367	67	-252660	89	-478612	111	-820237
24	-26937	46	-111545	68	-261037	90	-491208	112	-839697
25	-29494	47	-116855	69	-269578	91	-504050	113	-859594
26	-32171	48	-122298	70	-278284	92	-517127	114	-879943
27	-34968	49	-127877	71	-287157	93	-530455	115	-900763
28	-37885	50	-133591	72	-296202	94	-544031	116	-922072
29	-40922	51	-139441	73	-305420	95	-557862	117	-943891
30	-44080	52	-145430	74	-314810	96	-571956	118	-966241
31	-47360	53	-151557	75	-324380	97	-586324		
32	-50762	54	-157825	76	-334127	98	-600962		
33	-54287	55	-164233	77	-344059	99	-615887		

The ground state configurations used for each atomic number are reported in Table 1.

Table 13

Total binding energy (DF) of the isoelectronic series of aluminum (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
13	-6592	35	-62675	57	-180995	79	-372390	101	-661397
14	-7867	36	-66651	58	-187992	80	-383137	102	-677610
15	-9262	37	-70755	59	-195139	81	-394084	103	-694148
16	-10777	38	-74988	60	-202438	82	-405233	104	-711020
17	-12412	39	-79350	61	-209891	83	-416589	105	-728236
18	-14167	40	-83843	62	-217497	84	-428156	106	-745795
19	-16043	41	-88466	63	-225261	85	-439935	107	-763726
20	-18039	42	-93222	64	-233183	86	-451931	108	-782033
21	-20156	43	-98110	65	-241266	87	-464152	109	-800730
22	-22394	44	-103131	66	-249510	88	-476599	110	-819830
23	-24753	45	-108287	67	-257918	89	-489277	111	-839347
24	-27234	46	-113578	68	-266492	90	-502180	112	-859297
25	-29837	47	-119005	69	-275234	91	-515335	113	-879695
26	-32562	48	-124569	70	-284144	92	-528731	114	-900558
27	-35410	49	-130272	71	-293227	93	-542384	115	-921904
28	-38382	50	-136113	72	-302486	94	-556292	116	-943754
29	-41477	51	-142095	73	-311922	95	-570462	117	-966127
30	-44697	52	-148218	74	-321535	96	-584902	118	-989046
31	-48041	53	-154483	75	-331332	97	-599623		
32	-51510	54	-160893	76	-341312	98	-614621		
33	-55105	55	-167447	77	-351480	99	-629914		
34	-58827	56	-174147	78	-361840	100	-645506		

The ground state configurations used for each atomic number are reported in Table 1.

Table 14

Total binding energy (DF) of the isoelectronic series of silicon (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
14	-7875	35	-63593	56	-177413	77	-358754	98	-628069
15	-9281	36	-67647	57	-184411	78	-369352	99	-643726
16	-10811	37	-71833	58	-191562	79	-380146	100	-659689
17	-12465	38	-76150	59	-198868	80	-391142	101	-675960
18	-14241	39	-80600	60	-206329	81	-402343	102	-692561
19	-16141	40	-85184	61	-213947	82	-413751	103	-709494
20	-18165	41	-89902	62	-221724	83	-425372	104	-726771
21	-20313	42	-94756	63	-229661	84	-437208	105	-744400
22	-22585	43	-99745	64	-237761	85	-449262	106	-762382
23	-24981	44	-104871	65	-246026	86	-461539	107	-780744
24	-27503	45	-110135	66	-254455	87	-474046	108	-799494
25	-30149	46	-115537	67	-263053	88	-486784	109	-818643
26	-32921	47	-121079	68	-271821	89	-499760	110	-838205
27	-35819	48	-126761	69	-280761	90	-512967	111	-858196
28	-38843	49	-132585	70	-289875	91	-526431	112	-878630
29	-41994	50	-138552	71	-299164	92	-540143	113	-899524
30	-45272	51	-144662	72	-308635	93	-554119	114	-920896
31	-48679	52	-150918	73	-318286	94	-568356	115	-942764
32	-52213	53	-157319	74	-328120	95	-582862	116	-965149
33	-55877	54	-163868	75	-338142	96	-597644	117	-988072
34	-59670	55	-170565	76	-348351	97	-612714	118	-1011555

The ground state configurations used for each atomic number are reported in Table 1.

Table 15

Total binding energy (DF) of the isoelectronic series of phosphorus (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
15	-9291	36	-68583	57	-187633	78	-376270	99	-655832
16	-10834	37	-72846	58	-194928	79	-387276	100	-672082
17	-12504	38	-77244	59	-202380	80	-398488	101	-688643
18	-14300	39	-81778	60	-209991	81	-409908	102	-705537
19	-16223	40	-86449	61	-217763	82	-421539	103	-722768
20	-18272	41	-91258	62	-225695	83	-433385	104	-740346
21	-20449	42	-96204	63	-233792	84	-445451	105	-758280
22	-22753	43	-101290	64	-242055	85	-457738	106	-776571
23	-25184	44	-106515	65	-250486	86	-470251	107	-795245
24	-27744	45	-111881	66	-259084	87	-482998	108	-814310
25	-30431	46	-117389	67	-267855	88	-495980	109	-833779
26	-33247	47	-123040	68	-276799	89	-509203	110	-853666
27	-36192	48	-128834	69	-285918	90	-522660	111	-873984
28	-39267	49	-134773	70	-295214	91	-536378	112	-894749
29	-42471	50	-140858	71	-304689	92	-550347	113	-915979
30	-45806	51	-147090	72	-314348	93	-564584	114	-937690
31	-49272	52	-153470	73	-324193	94	-579086	115	-959901
32	-52869	53	-159999	74	-334222	95	-593859	116	-982633
33	-56598	54	-166679	75	-344442	96	-608913	117	-1005906
34	-60459	55	-173510	76	-354854	97	-624259	118	-1029744
35	-64454	56	-180494	77	-365462	98	-639893		

The ground state configurations used for each atomic number are reported in Table 1.

Table 16

Total binding energy (DF) of the isoelectronic series of sulfur (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
16	-10843	37	-73804	58	-198202	79	-394273	100	-684299
17	-12526	38	-78282	59	-205799	80	-405699	101	-701147
18	-14339	39	-82898	60	-213558	81	-417336	102	-718333
19	-16282	40	-87655	61	-221481	82	-429188	103	-735859
20	-18355	41	-92551	62	-229568	83	-441258	104	-753736
21	-20558	42	-97590	63	-237823	84	-453552	105	-771972
22	-22892	43	-102770	64	-246246	85	-466069	106	-790569
23	-25356	44	-108093	65	-254841	86	-478817	107	-809554
24	-27951	45	-113560	66	-263607	87	-491801	108	-828933
25	-30678	46	-119172	67	-272548	88	-505024	109	-848720
26	-33536	47	-124930	68	-281665	89	-518492	110	-868928
27	-36527	48	-130834	69	-290962	90	-532197	111	-889571
28	-39650	49	-136887	70	-300438	91	-546167	112	-910666
29	-42906	50	-143088	71	-310097	92	-560392	113	-932228
30	-46295	51	-149439	72	-319943	93	-574888	114	-954276
31	-49819	52	-155942	73	-329978	94	-589652	115	-976828
32	-53476	53	-162597	74	-340201	95	-604692	116	-999905
33	-57269	54	-169405	75	-350618	96	-620015	117	-1023527
34	-61198	55	-176369	76	-361230	97	-635634	118	-1047717
35	-65263	56	-183488	77	-372042	98	-651544		
36	-69465	57	-190766	78	-383057	99	-667765		

The ground state configurations used for each atomic number are reported in Table 1.

Table 17

Total binding energy (DF) of the isoelectronic series of chlorine (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
17	-12538	38	-79264	59	-209118	80	-412765	101	-713458
18	-14365	39	-83961	60	-217023	81	-424617	102	-730933
19	-16326	40	-88800	61	-225094	82	-436687	103	-748752
20	-18421	41	-93784	62	-233334	83	-448979	104	-766925
21	-20649	42	-98911	63	-241744	84	-461497	105	-785462
22	-23010	43	-104184	64	-250326	85	-474244	106	-804363
23	-25505	44	-109602	65	-259083	86	-487223	107	-823655
24	-28134	45	-115168	66	-268014	87	-500443	108	-843346
25	-30898	46	-120882	67	-277124	88	-513905	109	-863448
26	-33797	47	-126745	68	-286413	89	-527616	110	-883975
27	-36830	48	-132757	69	-295884	90	-541567	111	-904941
28	-40000	49	-138921	70	-305539	91	-555786	112	-926362
29	-43305	50	-145236	71	-315379	92	-570264	113	-948255
30	-46747	51	-151705	72	-325411	93	-585017	114	-970638
31	-50326	52	-158328	73	-335633	94	-600041	115	-993528
32	-54042	53	-165107	74	-346047	95	-615345	116	-1016946
33	-57897	54	-172042	75	-356660	96	-630935	117	-1040914
34	-61891	55	-179136	76	-367470	97	-646825	118	-1065455
35	-66023	56	-186389	77	-378483	98	-663010		
36	-70296	57	-193802	78	-389703	99	-679509		
37	-74709	58	-201378	79	-401127	100	-696324		

The ground state configurations used for each atomic number are reported in Table 1.

Table 18

Total binding energy (DF) of the isoelectronic series of argon (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
18	-14380	39	-84971	60	-220394	81	-431763	102	-743355
19	-16357	40	-89892	61	-228613	82	-444049	103	-761464
20	-18470	41	-94959	62	-237003	83	-456561	104	-779931
21	-20721	42	-100174	63	-245567	84	-469303	105	-798767
22	-23108	43	-105537	64	-254306	85	-482276	106	-817969
23	-25632	44	-111050	65	-263222	86	-495485	107	-837567
24	-28293	45	-116713	66	-272317	87	-508939	108	-857567
25	-31092	46	-122526	67	-281593	88	-522638	109	-877982
26	-34029	47	-128492	68	-291052	89	-536589	110	-898825
27	-37104	48	-134610	69	-300696	90	-550784	111	-920112
28	-40318	49	-140883	70	-310527	91	-565251	112	-941858
29	-43671	50	-147311	71	-320547	92	-579980	113	-964080
30	-47163	51	-153895	72	-330761	93	-594987	114	-986794
31	-50796	52	-160637	73	-341170	94	-610269	115	-1010020
32	-54569	53	-167538	74	-351774	95	-625834	116	-1033779
33	-58484	54	-174598	75	-362579	96	-641690	117	-1058090
34	-62540	55	-181819	76	-373585	97	-657848	118	-1082979
35	-66739	56	-189203	77	-384798	98	-674306		
36	-71080	57	-196752	78	-396220	99	-691080		
37	-75566	58	-204465	79	-407851	100	-708176		
38	-80196	59	-212345	80	-419698	101	-725593		

The ground state configurations used for each atomic number are reported in Table 1.

Table 19

Total binding energy (DF) of the isoelectronic series of potassium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
19	-16361	39	-85818	59	-215286	79	-414156	99	-702092
20	-18482	40	-90814	60	-223472	80	-426206	100	-719460
21	-20745	41	-95959	61	-231832	81	-438477	101	-737153
22	-23150	42	-101256	62	-240366	82	-450973	102	-755194
23	-25696	43	-106703	63	-249077	83	-463698	103	-773587
24	-28383	44	-112303	64	-257966	84	-476656	104	-792341
25	-31210	45	-118057	65	-267036	85	-489849	105	-811467
26	-34179	46	-123964	66	-276287	86	-503281	106	-830963
27	-37289	47	-130027	67	-285724	87	-516961	107	-850859
28	-40541	48	-136245	68	-295346	88	-530890	108	-871161
29	-43935	49	-142621	69	-305157	89	-545074	109	-891881
30	-47472	50	-149155	70	-315157	90	-559506	110	-913034
31	-51152	51	-155849	71	-325350	91	-574214	111	-934633
32	-54976	52	-162703	72	-335741	92	-589186	112	-956696
33	-58944	53	-169719	73	-346329	93	-604441	113	-979237
34	-63057	54	-176898	74	-357115	94	-619973	114	-1002276
35	-67316	55	-184241	75	-368107	95	-635793	115	-1025831
36	-71720	56	-191750	76	-379302	96	-651907	116	-1049921
37	-76272	57	-199426	77	-390708	97	-668327	117	-1074568
38	-80970	58	-207271	78	-402326	98	-685049	118	-1099796

The ground state configurations used for each atomic number are reported in Table 1.

Table 20

Total binding energy (DF) of the isoelectronic series of calcium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
20	-18487	40	-91677	60	-226446	80	-432562	100	-730542
21	-20757	41	-96899	61	-234944	81	-445037	101	-748508
22	-23177	42	-102275	62	-243619	82	-457740	102	-766826
23	-25742	43	-107805	63	-252475	83	-470675	103	-785499
24	-28452	44	-113490	64	-261512	84	-483847	104	-804537
25	-31305	45	-119331	65	-270734	85	-497257	105	-823951
26	-34303	46	-125330	66	-280139	86	-510910	106	-843739
27	-37446	47	-131487	67	-289733	87	-524814	107	-863930
28	-40733	48	-137803	68	-299516	88	-538970	108	-884530
29	-44166	49	-144280	69	-309492	89	-553386	109	-905553
30	-47745	50	-150918	70	-319659	90	-568052	110	-927012
31	-51471	51	-157718	71	-330023	91	-582997	111	-948922
32	-55343	52	-164682	72	-340587	92	-598211	112	-971298
33	-59362	53	-171812	73	-351353	93	-613710	113	-994158
34	-63530	54	-179107	74	-362320	94	-629491	114	-1017518
35	-67846	55	-186570	75	-373495	95	-645562	115	-1041397
36	-72311	56	-194202	76	-384877	96	-661932	116	-1065817
37	-76926	57	-202003	77	-396473	97	-678610	117	-1090797
38	-81692	58	-209977	78	-408285	98	-695595	118	-1116362
39	-86608	59	-218124	79	-420312	99	-712905		

The ground state configurations used for each atomic number are reported in Table 1.

Table 21

Total binding energy (DF) of the isoelectronic series of scandium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
21	-20762	41	-97776	61	-237941	81	-451429	101	-759639
22	-23190	42	-103228	62	-246756	82	-464337	102	-778232
23	-25770	43	-108837	63	-255754	83	-477479	103	-797183
24	-28500	44	-114605	64	-264936	84	-490862	104	-816502
25	-31377	45	-120533	65	-274307	85	-504487	105	-836200
26	-34401	46	-126620	66	-283864	86	-518358	106	-856277
27	-37574	47	-132869	67	-293613	87	-532483	107	-876760
28	-40895	48	-139280	68	-303554	88	-546864	108	-897656
29	-44364	49	-145855	69	-313691	89	-561507	109	-918979
30	-47983	50	-152594	70	-324023	90	-576405	110	-940741
31	-51751	51	-159499	71	-334555	91	-591585	111	-962958
32	-55669	52	-166571	72	-345290	92	-607038	112	-985645
33	-59737	53	-173811	73	-356230	93	-622779	113	-1008819
34	-63956	54	-181220	74	-367375	94	-638805	114	-1032497
35	-68327	55	-188800	75	-378731	95	-655126	115	-1056699
36	-72851	56	-196551	76	-390298	96	-671748	116	-1081445
37	-77527	57	-204476	77	-402082	97	-688682	117	-1106755
38	-82357	58	-212577	78	-414085	98	-705927	118	-1132654
39	-87341	59	-220853	79	-426306	99	-723499		
40	-92480	60	-229307	80	-438754	100	-741403		

The ground state configurations used for each atomic number are reported in Table 1.

Table 22

Total binding energy (DF) of the isoelectronic series of titanium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
22	-23195	42	-104118	62	-249784	82	-470779	102	-789432
23	-25783	43	-109805	63	-258922	83	-484127	103	-808658
24	-28529	44	-115653	64	-268248	84	-497718	104	-828256
25	-31427	45	-121664	65	-277765	85	-511555	105	-848236
26	-34475	46	-127838	66	-287471	86	-525641	106	-868599
27	-37676	47	-134177	67	-297373	87	-539985	107	-889372
28	-41027	48	-140681	68	-307470	88	-554588	108	-910561
29	-44530	49	-147351	69	-317766	89	-569457	109	-932180
30	-48186	50	-154190	70	-328261	90	-584584	110	-954243
31	-51994	51	-161197	71	-338958	91	-599997	111	-976764
32	-55955	52	-168374	72	-349863	92	-615685	112	-999760
33	-60070	53	-175722	73	-360975	93	-631666	113	-1023246
34	-64339	54	-183243	74	-372295	94	-647935	114	-1047240
35	-68763	55	-190937	75	-383830	95	-664502	115	-1071761
36	-73342	56	-198807	76	-395578	96	-681374	116	-1096830
37	-78077	57	-206853	77	-407548	97	-698562	117	-1122467
38	-82969	58	-215077	78	-419739	98	-716064	118	-1148697
39	-88018	59	-223481	79	-432152	99	-733897		
40	-93225	60	-232065	80	-444795	100	-752065		
41	-98592	61	-240833	81	-457670	101	-770569		

The ground state configurations used for each atomic number are reported in Table 1.

Table 23

Total binding energy (DF) of the isoelectronic series of vanadium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
23	-25790	43	-110709	63	-261944	83	-490485	103	-819577
24	-28544	44	-116634	64	-271408	84	-504275	104	-839435
25	-31459	45	-122725	65	-281065	85	-518314	105	-859679
26	-34529	46	-128983	66	-290916	86	-532605	106	-880308
27	-37754	47	-135408	67	-300965	87	-547157	107	-901351
28	-41134	48	-142001	68	-311212	88	-561971	108	-922813
29	-44668	49	-148764	69	-321661	89	-577055	109	-944708
30	-48359	50	-155698	70	-332312	90	-592399	110	-967050
31	-52205	51	-162803	71	-343169	91	-608032	111	-989853
32	-56207	52	-170081	72	-354235	92	-623943	112	-1013134
33	-60366	53	-177534	73	-365512	93	-640150	113	-1036908
34	-64682	54	-185162	74	-377001	94	-656650	114	-1061193
35	-69156	55	-192966	75	-388707	95	-673449	115	-1086009
36	-73788	56	-200949	76	-400630	96	-690557	116	-1111375
37	-78579	57	-209112	77	-412777	97	-707983	117	-1137314
38	-83531	58	-217455	78	-425149	98	-725727	118	-1163847
39	-88642	59	-225982	79	-437746	99	-743805		
40	-93915	60	-234692	80	-450575	100	-762221		
41	-99350	61	-243588	81	-463639	101	-780976		
42	-104947	62	-252671	82	-476941	102	-800094		

The ground state configurations used for each atomic number are reported in Table 1.

Table 24

Total binding energy (DF) of the isoelectronic series of chromium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
24	-28550	43	-111538	62	-255453	81	-469463	100	-772189
25	-31474	44	-117539	63	-264858	82	-482956	101	-791193
26	-34557	45	-123709	64	-274458	83	-496693	102	-810563
27	-37803	46	-130048	65	-284254	84	-510680	103	-830301
28	-41208	47	-136557	66	-294247	85	-524918	104	-850417
29	-44770	48	-143238	67	-304441	86	-539412	105	-870922
30	-48492	49	-150092	68	-314836	87	-554170	106	-891816
31	-52373	50	-157119	69	-325436	88	-569193	107	-913126
32	-56413	51	-164321	70	-336241	89	-584489	108	-934858
33	-60613	52	-171699	71	-347255	90	-600047	109	-957027
34	-64973	53	-179254	72	-358481	91	-615899	110	-979646
35	-69494	54	-186988	73	-369922	92	-632031	111	-1002729
36	-74177	55	-194902	74	-381576	93	-648463	112	-1026292
37	-79022	56	-202996	75	-393452	94	-665189	113	-1050352
38	-84030	57	-211274	76	-405547	95	-682219	114	-1074927
39	-89201	58	-219735	77	-417869	96	-699560	115	-1100035
40	-94537	59	-228382	78	-430419	97	-717223	116	-1125696
41	-100038	60	-237217	79	-443198	98	-735207	117	-1151933
42	-105705	61	-246240	80	-456211	99	-753527	118	-1178768

The ground state configurations used for each atomic number are reported in Table 1.

Table 25

Total binding energy (DF) of the isoelectronic series of manganese (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
25	-31480	44	-118384	63	-267665	82	-488818	101	-801213
26	-34573	45	-124630	64	-277399	83	-502747	102	-820832
27	-37834	46	-131048	65	-287332	84	-516928	103	-840823
28	-41261	47	-137639	66	-297464	85	-531363	104	-861195
29	-44849	48	-144405	67	-307800	86	-546058	105	-881958
30	-48599	49	-151347	68	-318341	87	-561019	106	-903114
31	-52512	50	-158466	69	-329089	88	-576249	107	-924689
32	-56588	51	-165762	70	-340046	89	-591754	108	-946689
33	-60826	52	-173237	71	-351215	90	-607525	109	-969129
34	-65228	53	-180893	72	-362599	91	-623592	110	-992022
35	-69795	54	-188730	73	-374200	92	-639944	111	-1015382
36	-74526	55	-196750	74	-386019	93	-656597	112	-1039226
37	-79422	56	-204954	75	-398061	94	-673548	113	-1063570
38	-84484	57	-213343	76	-410326	95	-690806	114	-1088431
39	-89713	58	-221920	77	-422821	96	-708378	115	-1113829
40	-95110	59	-230686	78	-435547	97	-726276	116	-1139783
41	-100674	60	-239642	79	-448505	98	-744496	117	-1166316
42	-106407	61	-248789	80	-461701	99	-763057	118	-1193450
43	-112311	62	-258129	81	-475137	100	-781962		

The ground state configurations used for each atomic number are reported in Table 1.

Table 26

Total binding energy (DF) of the isoelectronic series of iron (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
26	-34579	45	-125487	64	-280226	83	-508639	102	-830890
27	-37849	46	-131981	65	-290293	84	-523012	103	-851131
28	-41293	47	-138652	66	-300562	85	-537642	104	-871756
29	-44904	48	-145500	67	-311038	86	-552534	105	-892776
30	-48680	49	-152528	68	-321722	87	-567697	106	-914191
31	-52623	50	-159735	69	-332617	88	-583130	107	-936028
32	-56731	51	-167122	70	-343723	89	-598842	108	-958294
33	-61006	52	-174692	71	-355043	90	-614824	109	-981002
34	-65447	53	-182446	72	-366583	91	-631104	110	-1004167
35	-70056	54	-190383	73	-378343	92	-647672	111	-1027802
36	-74833	55	-198507	74	-390322	93	-664544	112	-1051924
37	-79778	56	-206818	75	-402529	94	-681718	113	-1076548
38	-84892	57	-215317	76	-414961	95	-699201	114	-1101693
39	-90176	58	-224007	77	-427627	96	-717001	115	-1127378
40	-95630	59	-232888	78	-440527	97	-735130	116	-1153623
41	-101255	60	-241963	79	-453661	98	-753585	117	-1180449
42	-107053	61	-251232	80	-467036	99	-772384	118	-1207879
43	-113024	62	-260698	81	-480655	100	-791530		
44	-119168	63	-270362	82	-494521	101	-811024		

The ground state configurations used for each atomic number are reported in Table 1.

Table 27

Total binding energy (DF) of the isoelectronic series of cobalt (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
27	-37857	46	-132850	65	-293145	84	-528942	103	-861240
28	-41308	47	-139598	66	-303549	85	-543764	104	-882116
29	-44938	48	-146526	67	-314163	86	-558852	105	-903390
30	-48737	49	-153637	68	-324987	87	-574213	106	-925061
31	-52706	50	-160930	69	-336026	88	-589848	107	-947158
32	-56845	51	-168407	70	-347278	89	-605765	108	-969687
33	-61153	52	-176069	71	-358749	90	-621954	109	-992662
34	-65631	53	-183918	72	-370441	91	-638445	110	-1016095
35	-70280	54	-191954	73	-382357	92	-655226	111	-1040003
36	-75099	55	-200179	74	-394495	93	-672316	112	-1064400
37	-80091	56	-208594	75	-406864	94	-689709	113	-1089303
38	-85254	57	-217201	76	-419462	95	-707416	114	-1114730
39	-90590	58	-226001	77	-432295	96	-725442	115	-1140699
40	-96100	59	-234996	78	-445366	97	-743800	116	-1167231
41	-101785	60	-244187	79	-458674	98	-762487	117	-1194348
42	-107644	61	-253576	80	-472227	99	-781521	118	-1222072
43	-113679	62	-263164	81	-486026	100	-800905		
44	-119891	63	-272953	82	-500076	101	-820641		
45	-126281	64	-282946	83	-514379	102	-840752		

The ground state configurations used for each atomic number are reported in Table 1.

Table 28

Total binding energy (DF) of the isoelectronic series of nickel (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
28	-41316	47	-140483	66	-306431	85	-549740	104	-892286
29	-44955	48	-147489	67	-317181	86	-565021	105	-913811
30	-48774	49	-154680	68	-328144	87	-580578	106	-935737
31	-52767	50	-162057	69	-339324	88	-596413	107	-958092
32	-56933	51	-169621	70	-350721	89	-612532	108	-980882
33	-61272	52	-177373	71	-362339	90	-628926	109	-1004120
34	-65784	53	-185315	72	-374182	91	-645626	110	-1027820
35	-70470	54	-193447	73	-386252	92	-662619	111	-1051998
36	-75331	55	-201771	74	-398547	93	-679923	112	-1076668
37	-80366	56	-210289	75	-411075	94	-697534	113	-1101847
38	-85576	57	-219001	76	-423836	95	-715461	114	-1127553
39	-90963	58	-227909	77	-436835	96	-733711	115	-1153805
40	-96526	59	-237015	78	-450075	97	-752296	116	-1180622
41	-102267	60	-246321	79	-463555	98	-771213	117	-1208028
42	-108186	61	-255827	80	-477282	99	-790480	118	-1236043
43	-114283	62	-265535	81	-491260	100	-810101		
44	-120561	63	-275448	82	-505490	101	-830075		
45	-127020	64	-285567	83	-519978	102	-850428		
46	-133660	65	-295895	84	-534727	103	-871162		

The ground state configurations used for each atomic number are reported in Table 1.

Table 29

Total binding energy (DF) of the isoelectronic series of copper (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
29	-44962	47	-140982	65	-297504	83	-523380	101	-836108
30	-48791	48	-148034	66	-308121	84	-538251	102	-856637
31	-52797	49	-155272	67	-318954	85	-553389	103	-877550
32	-56977	50	-162698	68	-330002	86	-568797	104	-898857
33	-61333	51	-170313	69	-341269	87	-584484	105	-920570
34	-65865	52	-178118	70	-352755	88	-600452	106	-942687
35	-70572	53	-186115	71	-364465	89	-616706	107	-965236
36	-75455	54	-194303	72	-376402	90	-633239	108	-988225
37	-80515	55	-202686	73	-388567	91	-650079	109	-1011666
38	-85753	56	-211264	74	-400960	92	-667216	110	-1035574
39	-91168	57	-220039	75	-413589	93	-684667	111	-1059963
40	-96761	58	-229011	76	-426452	94	-702428	112	-1084849
41	-102534	59	-238184	77	-439556	95	-720508	113	-1110249
42	-108487	60	-247558	78	-452903	96	-738915	114	-1136181
43	-114621	61	-257134	79	-466493	97	-757659	115	-1162663
44	-120936	62	-266915	80	-480333	98	-776738	116	-1189717
45	-127434	63	-276902	81	-494425	99	-796171	117	-1217363
46	-134116	64	-287098	82	-508772	100	-815960	118	-1245625

The ground state configurations used for each atomic number are reported in Table 1.

Table 30

Total binding energy (DF) of the isoelectronic series of zinc (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
30	-48799	48	-148547	66	-309759	84	-541701	102	-862746
31	-52815	49	-155832	67	-320673	85	-556962	103	-883837
32	-57010	50	-163306	68	-331805	86	-572496	104	-905326
33	-61381	51	-170970	69	-343158	87	-588312	105	-927224
34	-65930	52	-178827	70	-354733	88	-604411	106	-949530
35	-70657	53	-186877	71	-366532	89	-620799	107	-972273
36	-75562	54	-195121	72	-378561	90	-637469	108	-995459
37	-80646	55	-203561	73	-390821	91	-654449	109	-1019101
38	-85909	56	-212199	74	-403312	92	-671729	110	-1043215
39	-91351	57	-221034	75	-416039	93	-689325	111	-1067814
40	-96974	58	-230071	76	-429004	94	-707235	112	-1092915
41	-102778	59	-239308	77	-442212	95	-725466	113	-1118534
42	-108764	60	-248749	78	-455665	96	-744027	114	-1144689
43	-114932	61	-258395	79	-469363	97	-762929	115	-1171401
44	-121284	62	-268247	80	-483314	98	-782170	116	-1198688
45	-127821	63	-278308	81	-497519	99	-801767	117	-1226573
46	-134543	64	-288579	82	-511983	100	-821724	118	-1255079
47	-141451	65	-299063	83	-526709	101	-842042		

The ground state configurations used for each atomic number are reported in Table 1.

Table 31

Total binding energy (DF) of the isoelectronic series of gallium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
31	-52821	49	-156324	67	-322271	85	-560350	103	-889863
32	-57025	50	-163843	68	-333483	86	-576006	104	-911529
33	-61409	51	-171554	69	-344919	87	-591947	105	-933608
34	-65973	52	-179460	70	-356578	88	-608173	106	-956099
35	-70716	53	-187560	71	-368465	89	-624692	107	-979030
36	-75640	54	-195857	72	-380583	90	-641494	108	-1002409
37	-80744	55	-204352	73	-392934	91	-658610	109	-1026249
38	-86029	56	-213045	74	-405517	92	-676028	110	-1050564
39	-91496	57	-221940	75	-418341	93	-693766	111	-1075369
40	-97145	58	-231036	76	-431404	94	-711820	112	-1100680
41	-102977	59	-240336	77	-444712	95	-730199	113	-1126514
42	-108993	60	-249841	78	-458268	96	-748910	114	-1152890
43	-115194	61	-259553	79	-472071	97	-767965	115	-1179826
44	-121580	62	-269473	80	-486129	98	-787362	116	-1207344
45	-128152	63	-279604	81	-500444	99	-807119	117	-1235465
46	-134912	64	-289947	82	-515019	100	-827239	118	-1264213
47	-141859	65	-300506	83	-529860	101	-847724		
48	-148996	66	-311279	84	-544969	102	-868598		

The ground state configurations used for each atomic number are reported in Table 1.

Table 32

Total binding energy (DF) of the isoelectronic series of germanium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
32	-57032	50	-164349	68	-335108	86	-579439	104	-917628
33	-61427	51	-172106	69	-346625	87	-595503	105	-939886
34	-66004	52	-180059	70	-358375	88	-611855	106	-962560
35	-70762	53	-188209	71	-370340	89	-628503	107	-985679
36	-75703	54	-196557	72	-382546	90	-645437	108	-1009249
37	-80827	55	-205105	73	-394987	91	-662687	109	-1033284
38	-86133	56	-213854	74	-407662	92	-680242	110	-1057798
39	-91623	57	-222805	75	-420581	93	-698119	111	-1082807
40	-97298	58	-231960	76	-433740	94	-716316	112	-1108327
41	-103157	59	-241321	77	-447147	95	-734841	113	-1134374
42	-109201	60	-250890	78	-460804	96	-753701	114	-1160968
43	-115433	61	-260666	79	-474711	97	-772908	115	-1188128
44	-121851	62	-270653	80	-488874	98	-792460	116	-1215874
45	-128458	63	-280853	81	-503298	99	-812375	117	-1244229
46	-135254	64	-291268	82	-517984	100	-832657	118	-1273217
47	-142240	65	-301899	83	-532938	101	-853307		
48	-149417	66	-312747	84	-548163	102	-874349		
49	-156786	67	-323816	85	-563662	103	-895786		

The ground state configurations used for each atomic number are reported in Table 1.

Table 33

Total binding energy (DF) of the isoelectronic series of arsenic (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
33	-61436	51	-172616	69	-348216	87	-598760	105	-945420
34	-66024	52	-180614	70	-360036	88	-615223	106	-968239
35	-70797	53	-188810	71	-372087	89	-631982	107	-991505
36	-75753	54	-197207	72	-384373	90	-649030	108	-1015224
37	-80895	55	-205805	73	-396897	91	-666396	109	-1039410
38	-86221	56	-214606	74	-409657	92	-684069	110	-1064078
39	-91733	57	-223611	75	-422661	93	-702066	111	-1089242
40	-97430	58	-232822	76	-435908	94	-720384	112	-1114918
41	-103315	59	-242241	77	-449405	95	-739032	113	-1141125
42	-109387	60	-251868	78	-463154	96	-758018	114	-1167880
43	-115647	61	-261706	79	-477154	97	-777353	115	-1195203
44	-122096	62	-271756	80	-491413	98	-797034	116	-1223115
45	-128735	63	-282020	81	-505933	99	-817080	117	-1251637
46	-135565	64	-292501	82	-520719	100	-837495	118	-1280795
47	-142587	65	-303200	83	-535773	101	-858281		
48	-149802	66	-314118	84	-551101	102	-879460		
49	-157211	67	-325259	85	-566704	103	-901036		
50	-164815	68	-336624	86	-582588	104	-923019		

The ground state configurations used for each atomic number are reported in Table 1.

Table 34

Total binding energy (DF) of the isoelectronic series of selenium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
34	-66033	51	-173095	68	-338092	85	-569681	102	-884486
35	-70817	52	-181136	69	-349758	86	-585670	103	-906200
36	-75788	53	-189379	70	-361654	87	-601950	104	-928323
37	-80945	54	-197823	71	-373783	88	-618521	105	-950866
38	-86290	55	-206471	72	-386149	89	-635391	106	-973829
39	-91822	56	-215323	73	-398754	90	-652552	107	-997241
40	-97542	57	-224381	74	-411597	91	-670033	108	-1021108
41	-103451	58	-233646	75	-424686	92	-687822	109	-1045444
42	-109549	59	-243121	76	-438020	93	-705938	110	-1070264
43	-115837	60	-252807	77	-451606	94	-724377	111	-1095582
44	-122316	61	-262704	78	-465445	95	-743147	112	-1121415
45	-128987	62	-272816	79	-479537	96	-762257	113	-1147779
46	-135851	63	-283144	80	-493891	97	-781718	114	-1174695
47	-142908	64	-293690	81	-508507	98	-801528	115	-1202180
48	-150160	65	-304456	82	-523390	99	-821704	116	-1230256
49	-157607	66	-315443	83	-538544	100	-842252	117	-1258944
50	-165252	67	-326654	84	-553974	101	-863171	118	-1288270

The ground state configurations used for each atomic number are reported in Table 1.

Table 35

Total binding energy (DF) of the isoelectronic series of bromine (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
35	-70828	52	-181627	69	-351248	86	-588680	103	-911272
36	-75811	53	-189914	70	-363218	87	-605065	104	-933533
37	-80983	54	-198405	71	-375424	88	-621745	105	-956217
38	-86345	55	-207100	72	-387868	89	-638725	106	-979323
39	-91896	56	-216002	73	-400553	90	-655997	107	-1002880
40	-97637	57	-225112	74	-413479	91	-673591	108	-1026893
41	-103569	58	-234431	75	-426652	92	-691497	109	-1051378
42	-109692	59	-243961	76	-440072	93	-709730	110	-1076348
43	-116006	60	-253703	77	-453745	94	-728288	111	-1101819
44	-122514	61	-263660	78	-467673	95	-747180	112	-1127807
45	-129215	62	-273832	79	-481857	96	-766413	113	-1154329
46	-136111	63	-284222	80	-496303	97	-785999	114	-1181403
47	-143202	64	-294832	81	-511015	98	-805935	115	-1209049
48	-150489	65	-305664	82	-525995	99	-826241	116	-1237287
49	-157975	66	-316718	83	-541247	100	-846919	117	-1266141
50	-165659	67	-328000	84	-556777	101	-867971	118	-1295634
51	-173542	68	-339508	85	-572586	102	-889421		

The ground state configurations used for each atomic number are reported in Table 1.

Table 36

Total binding energy (DF) of the isoelectronic series of krypton (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
36	-75824	53	-190419	70	-364734	87	-608114	104	-938658
37	-81010	54	-198954	71	-377015	88	-624900	105	-961482
38	-86387	55	-207697	72	-389537	89	-641989	106	-984729
39	-91956	56	-216648	73	-402301	90	-659372	107	-1008429
40	-97716	57	-225808	74	-415308	91	-677079	108	-1032589
41	-103670	58	-235180	75	-428564	92	-695099	109	-1057221
42	-109816	59	-244764	76	-442068	93	-713448	110	-1082341
43	-116156	60	-254562	77	-455828	94	-732124	111	-1107963
44	-122691	61	-264576	78	-469844	95	-751136	112	-1134105
45	-129421	62	-274808	79	-484118	96	-770491	113	-1160782
46	-136348	63	-285259	80	-498657	97	-790201	114	-1188014
47	-143472	64	-295932	81	-513462	98	-810264	115	-1215820
48	-150794	65	-306829	82	-528538	99	-830697	116	-1244220
49	-158316	66	-317950	83	-543888	100	-851505	117	-1273238
50	-166038	67	-329300	84	-559517	101	-872689	118	-1302897
51	-173962	68	-340878	85	-575427	102	-894272		
52	-182088	69	-352690	86	-591624	103	-916259		

The ground state configurations used for each atomic number are reported in Table 1.

Table 37

Total binding energy (DF) of the isoelectronic series of rubidium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
37	-81013	54	-199388	71	-378410	88	-627776	105	-966379
38	-86397	55	-208173	72	-391004	89	-644969	106	-989762
39	-91975	56	-217168	73	-403843	90	-662458	107	-1013601
40	-97750	57	-226374	74	-416926	91	-680272	108	-1037900
41	-103719	58	-235793	75	-430260	92	-698400	109	-1062675
42	-109884	59	-245427	76	-443844	93	-716861	110	-1087939
43	-116244	60	-255276	77	-457685	94	-735651	111	-1113707
44	-122801	61	-265343	78	-471785	95	-754777	112	-1139997
45	-129556	62	-275630	79	-486144	96	-774249	113	-1166824
46	-136508	63	-286138	80	-500770	97	-794078	114	-1194208
47	-143660	64	-296869	81	-515664	98	-814262	115	-1222168
48	-151012	65	-307826	82	-530830	99	-834817	116	-1250725
49	-158565	66	-319009	83	-546273	100	-855750	117	-1279901
50	-166320	67	-330422	84	-561997	101	-877060	118	-1309720
51	-174279	68	-342066	85	-578003	102	-898772		
52	-182442	69	-353945	86	-594298	103	-920889		
53	-190812	70	-366058	87	-610888	104	-943421		

The ground state configurations used for each atomic number are reported in Table 1.

Table 38

Total binding energy (DF) of the isoelectronic series of strontium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
38	-86402	55	-208618	72	-392421	89	-647877	106	-994704
39	-91986	56	-217656	73	-405333	90	-665471	107	-1018679
40	-97772	57	-226907	74	-418490	91	-683391	108	-1043118
41	-103756	58	-236372	75	-431901	92	-701628	109	-1068033
42	-109937	59	-246054	76	-445564	93	-720199	110	-1093440
43	-116316	60	-255954	77	-459486	94	-739100	111	-1119354
44	-122894	61	-266073	78	-473668	95	-758340	112	-1145790
45	-129671	62	-276412	79	-488111	96	-777928	113	-1172767
46	-136649	63	-286976	80	-502822	97	-797875	114	-1200301
47	-143827	64	-297764	81	-517804	98	-818177	115	-1228414
48	-151207	65	-308780	82	-533060	99	-838855	116	-1257126
49	-158791	66	-320023	83	-548594	100	-859910	117	-1286459
50	-166578	67	-331499	84	-564411	101	-881346	118	-1316437
51	-174571	68	-343208	85	-580513	102	-903185		
52	-182770	69	-355152	86	-596904	103	-925431		
53	-191177	70	-367333	87	-613594	104	-948094		
54	-199792	71	-379755	88	-630582	105	-971185		

The ground state configurations used for each atomic number are reported in Table 1.

Table 39

Total binding energy (DF) of the isoelectronic series of yttrium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
39	-91992	55	-209031	71	-381047	87	-616225	103	-929879
40	-97784	56	-218111	72	-393783	88	-633313	104	-952671
41	-103780	57	-227405	73	-406767	89	-650710	105	-975894
42	-109976	58	-236915	74	-419998	90	-668406	106	-999546
43	-116373	59	-246644	75	-433484	91	-686431	107	-1023657
44	-122970	60	-256592	76	-447224	92	-704775	108	-1048233
45	-129768	61	-266762	77	-461225	93	-723454	109	-1073288
46	-136769	62	-277154	78	-475489	94	-742466	110	-1098837
47	-143972	63	-287771	79	-490015	95	-761819	111	-1124894
48	-151380	64	-298615	80	-504811	96	-781521	112	-1151476
49	-158992	65	-309689	81	-519879	97	-801584	113	-1178600
50	-166810	66	-320992	82	-535223	98	-822005	114	-1206284
51	-174836	67	-332528	83	-550847	99	-842802	115	-1234549
52	-183069	68	-344300	84	-566756	100	-863980	116	-1263414
53	-191512	69	-356309	85	-582952	101	-885540	117	-1292903
54	-200166	70	-368557	86	-599439	102	-907505	118	-1323039

The ground state configurations used for each atomic number are reported in Table 1.

Table 40

Total binding energy (DF) of the isoelectronic series of zirconium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
40	-97790	56	-218533	72	-395094	88	-635975	104	-957160
41	-103793	57	-227869	73	-408149	89	-653472	105	-980513
42	-110002	58	-237424	74	-421453	90	-671270	106	-1004298
43	-116414	59	-247198	75	-435014	91	-689399	107	-1028543
44	-123029	60	-257194	76	-448830	92	-707848	108	-1053256
45	-129848	61	-267413	77	-462909	93	-726635	109	-1078449
46	-136870	62	-277856	78	-477252	94	-745756	110	-1104138
47	-144097	63	-288526	79	-491860	95	-765221	111	-1130337
48	-151530	64	-299425	80	-506739	96	-785036	112	-1157064
49	-159170	65	-310555	81	-521893	97	-805214	113	-1184334
50	-167018	66	-321916	82	-537324	98	-825752	114	-1212167
51	-175074	67	-333513	83	-553037	99	-846668	115	-1240581
52	-183341	68	-345346	84	-569037	100	-867966	116	-1269599
53	-191819	69	-357419	85	-585325	101	-889649	117	-1299242
54	-200509	70	-369732	86	-601906	102	-911739	118	-1329534
55	-209413	71	-382289	87	-618789	103	-934239		

The ground state configurations used for each atomic number are reported in Table 1.

Table 41

Total binding energy (DF) of the isoelectronic series of niobium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
41	-103799	57	-228300	73	-409462	89	-656111	105	-984924
42	-110017	58	-237896	74	-422836	90	-674007	106	-1008835
43	-116443	59	-247714	75	-436468	91	-692236	107	-1033207
44	-123074	60	-257756	76	-450358	92	-710786	108	-1058049
45	-129911	61	-268022	77	-464512	93	-729676	109	-1083373
46	-136954	62	-278514	78	-478932	94	-748902	110	-1109194
47	-144203	63	-289235	79	-493618	95	-768472	111	-1135528
48	-151660	64	-300186	80	-508578	96	-788396	112	-1162390
49	-159326	65	-311371	81	-523813	97	-808683	113	-1189798
50	-167202	66	-322788	82	-539328	98	-829333	114	-1217771
51	-175288	67	-334442	83	-555127	99	-850362	115	-1246327
52	-183586	68	-346335	84	-571214	100	-871776	116	-1275488
53	-192098	69	-358469	85	-587591	101	-893575	117	-1305275
54	-200823	70	-370846	86	-604263	102	-915784	118	-1335714
55	-209765	71	-383467	87	-621239	103	-938404		
56	-218923	72	-396339	88	-638519	104	-961447		

The ground state configurations used for each atomic number are reported in Table 1.

Table 42

Total binding energy (DF) of the isoelectronic series of molybdenum (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
42	-110024	58	-238331	74	-424167	90	-676676	106	-1013285
43	-116457	59	-248192	75	-437870	91	-695002	107	-1037783
44	-123101	60	-258278	76	-451832	92	-713653	108	-1062753
45	-129953	61	-268591	77	-466060	93	-732645	109	-1088206
46	-137015	62	-279131	78	-480556	94	-751974	110	-1114159
47	-144285	63	-289902	79	-495320	95	-771650	111	-1140626
48	-151765	64	-300905	80	-510358	96	-791680	112	-1167623
49	-159456	65	-312143	81	-525675	97	-812076	113	-1195168
50	-167358	66	-323615	82	-541273	98	-832836	114	-1223279
51	-175473	67	-335327	83	-557156	99	-853978	115	-1251975
52	-183801	68	-347278	84	-573329	100	-875506	116	-1281278
53	-192345	69	-359473	85	-589794	101	-897420	117	-1311209
54	-201104	70	-371911	86	-606556	102	-919746	118	-1341794
55	-210081	71	-384597	87	-623623	103	-942486		
56	-219277	72	-397534	88	-640996	104	-965650		
57	-228693	73	-410724	89	-658683	105	-989250		

The ground state configurations used for each atomic number are reported in Table 1.

Table 43

Total binding energy (DF) of the isoelectronic series of technetium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
43	-116463	59	-248637	75	-439219	91	-697698	107	-1042269
44	-123115	60	-258767	76	-453252	92	-716447	108	-1067365
45	-129983	61	-269125	77	-467553	93	-735539	109	-1092947
46	-137061	62	-279712	78	-482123	94	-754971	110	-1119030
47	-144350	63	-290532	79	-496964	95	-774751	111	-1145629
48	-151852	64	-301585	80	-512081	96	-794887	112	-1172760
49	-159565	65	-312875	81	-527477	97	-815391	113	-1200440
50	-167493	66	-324401	82	-543157	98	-836260	114	-1228688
51	-175635	67	-336169	83	-559123	99	-857513	115	-1257523
52	-183992	68	-348177	84	-575381	100	-879153	116	-1286967
53	-192566	69	-360431	85	-591933	101	-901182	117	-1317041
54	-201359	70	-372930	86	-608783	102	-923624	118	-1347769
55	-210370	71	-385678	87	-625940	103	-946482		
56	-219602	72	-398680	88	-643405	104	-969766		
57	-229057	73	-411935	89	-661186	105	-993487		
58	-238734	74	-425446	90	-679274	106	-1017645		

The ground state configurations used for each atomic number are reported in Table 1.

Table 44

Total binding energy (DF) of the isoelectronic series of ruthenium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
44	-123122	59	-249049	74	-426672	89	-663616	104	-973791
45	-129999	60	-259220	75	-440513	90	-681798	105	-997632
46	-137092	61	-269622	76	-454616	91	-700318	106	-1021912
47	-144399	62	-280255	77	-468989	92	-719165	107	-1046659
48	-151920	63	-291122	78	-483632	93	-738356	108	-1071881
49	-159655	64	-302224	79	-498548	94	-757889	109	-1097590
50	-167606	65	-313565	80	-513742	95	-777772	110	-1123802
51	-175774	66	-325144	81	-529217	96	-798012	111	-1150532
52	-184159	67	-336966	82	-544976	97	-818623	112	-1177795
53	-192763	68	-349030	83	-561025	98	-839600	113	-1205609
54	-201586	69	-361342	84	-577367	99	-860962	114	-1233993
55	-210631	70	-373901	85	-594004	100	-882714	115	-1262966
56	-219898	71	-386710	86	-610941	101	-904857	116	-1292549
57	-229389	72	-399774	87	-628187	102	-927414	117	-1322764
58	-239105	73	-413095	88	-645743	103	-950388	118	-1353636

The ground state configurations used for each atomic number are reported in Table 1.

Table 45

Total binding energy (DF) of the isoelectronic series of rhodium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
45	-130005	60	-259640	75	-441755	90	-684253	105	-1001689
46	-137110	61	-270084	76	-455927	91	-702868	106	-1026090
47	-144432	62	-280761	77	-470370	92	-721811	107	-1050960
48	-151971	63	-291675	78	-485086	93	-741101	108	-1076306
49	-159726	64	-302825	79	-500075	94	-760733	109	-1102141
50	-167700	65	-314216	80	-515345	95	-780718	110	-1128481
51	-175891	66	-325846	81	-530898	96	-801062	111	-1155340
52	-184302	67	-337721	82	-546736	97	-821777	112	-1182734
53	-192934	68	-349840	83	-562865	98	-842861	113	-1210682
54	-201788	69	-362208	84	-579290	99	-864332	114	-1239201
55	-210864	70	-374825	85	-596011	100	-886194	115	-1268310
56	-220165	71	-387695	86	-613035	101	-908449	116	-1298031
57	-229692	72	-400821	87	-630369	102	-931119	117	-1328386
58	-239445	73	-414205	88	-648014	103	-954209	118	-1359399
59	-249427	74	-427848	89	-665978	104	-977729		

The ground state configurations used for each atomic number are reported in Table 1.

Table 46

Total binding energy (DF) of the isoelectronic series of palladium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
46	-137116	61	-270514	76	-457189	91	-705351	106	-1030185
47	-144451	62	-281235	77	-471701	92	-724389	107	-1055176
48	-152006	63	-292193	78	-486488	93	-743776	108	-1080645
49	-159781	64	-303390	79	-501550	94	-763507	109	-1106605
50	-167775	65	-314829	80	-516894	95	-783592	110	-1133071
51	-175989	66	-326510	81	-532523	96	-804038	111	-1160059
52	-184425	67	-338436	82	-548440	97	-824857	112	-1187583
53	-193084	68	-350610	83	-564649	98	-846047	113	-1215663
54	-201966	69	-363033	84	-581155	99	-867626	114	-1244315
55	-211073	70	-375707	85	-597959	100	-889597	115	-1273560
56	-220406	71	-388636	86	-615068	101	-911962	116	-1303418
57	-229967	72	-401823	87	-632488	102	-934746	117	-1333912
58	-239757	73	-415269	88	-650222	103	-957950	118	-1365066
59	-249777	74	-428976	89	-668276	104	-981586		
60	-260029	75	-442949	90	-686643	105	-1005664		

The ground state configurations used for each atomic number are reported in Table 1.

Table 47

Total binding energy (DF) of the isoelectronic series of silver (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
47	-144458	62	-281532	77	-472580	92	-726160	107	-1058201
48	-152022	63	-292520	78	-487417	93	-745618	108	-1083769
49	-159807	64	-303748	79	-502529	94	-765422	109	-1109830
50	-167814	65	-315219	80	-517926	95	-785582	110	-1136400
51	-176043	66	-326933	81	-533608	96	-806105	111	-1163492
52	-184494	67	-338895	82	-549580	97	-827002	112	-1191125
53	-193170	68	-351104	83	-565845	98	-848272	113	-1219314
54	-202070	69	-363565	84	-582409	99	-869932	114	-1248078
55	-211197	70	-376278	85	-599272	100	-891986	115	-1277438
56	-220551	71	-389247	86	-616441	101	-914437	116	-1307413
57	-230134	72	-402475	87	-633924	102	-937307	117	-1338027
58	-239947	73	-415964	88	-651722	103	-960601	118	-1369303
59	-249992	74	-429715	89	-669841	104	-984327		
60	-260270	75	-443734	90	-688275	105	-1008498		
61	-270783	76	-458020	91	-707051	106	-1033113		

The ground state configurations used for each atomic number are reported in Table 1.

Table 48

Total binding energy (DF) of the isoelectronic series of cadmium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
48	-152029	63	-292824	78	-488312	93	-747414	108	-1086835
49	-159824	64	-304083	79	-503474	94	-767291	109	-1112996
50	-167842	65	-315586	80	-518922	95	-787524	110	-1139667
51	-176084	66	-327333	81	-534657	96	-808123	111	-1166864
52	-184550	67	-339328	82	-550683	97	-829097	112	-1194603
53	-193242	68	-351573	83	-567004	98	-850446	113	-1222901
54	-202160	69	-364071	84	-583624	99	-872187	114	-1251777
55	-211305	70	-376822	85	-600547	100	-894324	115	-1281250
56	-220679	71	-389829	86	-617776	101	-916859	116	-1311342
57	-230284	72	-403098	87	-635320	102	-939816	117	-1342074
58	-240119	73	-416629	88	-653180	103	-963197	118	-1373471
59	-250188	74	-430423	89	-671364	104	-987013		
60	-260491	75	-444487	90	-689864	105	-1011276		
61	-271031	76	-458819	91	-708707	106	-1035985		
62	-281807	77	-473426	92	-727885	107	-1061169		

The ground state configurations used for each atomic number are reported in Table 1.

Table 49

Total binding energy (DF) of the isoelectronic series of indium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
49	-159830	63	-293086	77	-474200	91	-710258	105	-1013911
50	-167856	64	-304373	78	-489131	92	-729502	106	-1038711
51	-176109	65	-315905	79	-504342	93	-749099	107	-1063988
52	-184587	66	-327683	80	-519838	94	-769046	108	-1089749
53	-193293	67	-339711	81	-535624	95	-789351	109	-1116008
54	-202226	68	-351989	82	-551702	96	-810022	110	-1142778
55	-211388	69	-364521	83	-568076	97	-831071	111	-1170077
56	-220780	70	-377308	84	-584751	98	-852496	112	-1197920
57	-230403	71	-390353	85	-601730	99	-874315	113	-1226324
58	-240259	72	-403660	86	-619016	100	-896532	114	-1255308
59	-250350	73	-417231	87	-636619	101	-919149	115	-1284893
60	-260676	74	-431066	88	-654540	102	-942189	116	-1315098
61	-271240	75	-445171	89	-672786	103	-965656	117	-1345947
62	-282042	76	-459547	90	-691349	104	-989559	118	-1377463

The ground state configurations used for each atomic number are reported in Table 1.

Table 50

Total binding energy (DF) of the isoelectronic series of tin (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
50	-167863	64	-304642	78	-489919	92	-731076	106	-1041381
51	-176125	65	-316203	79	-505176	93	-750740	107	-1066750
52	-184614	66	-328011	80	-520721	94	-770756	108	-1092605
53	-193332	67	-340070	81	-536556	95	-791131	109	-1118960
54	-202280	68	-352380	82	-552685	96	-811874	110	-1145829
55	-211457	69	-364946	83	-569112	97	-832997	111	-1173228
56	-220866	70	-377768	84	-585841	98	-854498	112	-1201174
57	-230508	71	-390849	85	-602875	99	-876394	113	-1229684
58	-240384	72	-404194	86	-620218	100	-898690	114	-1258775
59	-250495	73	-417804	87	-637880	101	-921387	115	-1288470
60	-260844	74	-431679	88	-655860	102	-944510	116	-1318788
61	-271431	75	-445826	89	-674167	103	-968061	117	-1349751
62	-282258	76	-460245	90	-692793	104	-992051	118	-1381386
63	-293328	77	-474942	91	-711766	105	-1016491		

The ground state configurations used for each atomic number are reported in Table 1.

Table 51

Total binding energy (DF) of the isoelectronic series of antimony (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
51	-176133	65	-316472	79	-505942	93	-752232	107	-1069200
52	-184632	66	-328307	80	-521531	94	-772308	108	-1095132
53	-193361	67	-340395	81	-537412	95	-792745	109	-1121566
54	-202321	68	-352736	82	-553587	96	-813552	110	-1148515
55	-211513	69	-365334	83	-570062	97	-834739	111	-1175996
56	-220937	70	-378188	84	-586840	98	-856305	112	-1204024
57	-230596	71	-391303	85	-603924	99	-878268	113	-1232617
58	-240490	72	-404683	86	-621318	100	-900631	114	-1261794
59	-250621	73	-418329	87	-639032	101	-923398	115	-1291574
60	-260990	74	-432241	88	-657066	102	-946591	116	-1321980
61	-271600	75	-446427	89	-675428	103	-970213	117	-1353032
62	-282450	76	-460885	90	-694110	104	-994276	118	-1384756
63	-293544	77	-475623	91	-713140	105	-1018789		
64	-304884	78	-490642	92	-732508	106	-1043755		

The ground state configurations used for each atomic number are reported in Table 1.

Table 52

Total binding energy (DF) of the isoelectronic series of tellurium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
52	-184640	66	-328583	80	-522311	94	-773821	108	-1097611
53	-193379	67	-340699	81	-538237	95	-794319	109	-1124123
54	-202351	68	-353070	82	-554458	96	-815188	110	-1151151
55	-211556	69	-365698	83	-570979	97	-836439	111	-1178712
56	-220995	70	-378585	84	-587806	98	-858070	112	-1206822
57	-230670	71	-391733	85	-604939	99	-880098	113	-1235498
58	-240581	72	-405147	86	-622384	100	-902529	114	-1264759
59	-250731	73	-418828	87	-640150	101	-925364	115	-1294625
60	-261121	74	-432777	88	-658237	102	-948626	116	-1325117
61	-271751	75	-447001	89	-676653	103	-972320	117	-1356258
62	-282624	76	-461498	90	-695390	104	-996454	118	-1388071
63	-293742	77	-476276	91	-714476	105	-1021041		
64	-305107	78	-491336	92	-733902	106	-1046081		
65	-316720	79	-506679	93	-753685	107	-1071602		

The ground state configurations used for each atomic number are reported in Table 1.

Table 53

Total binding energy (DF) of the isoelectronic series of iodine (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
53	-193388	67	-340982	81	-539029	95	-795850	109	-1126625
54	-202371	68	-353381	82	-555295	96	-816780	110	-1153732
55	-211588	69	-366039	83	-571863	97	-838094	111	-1181373
56	-221041	70	-378957	84	-588737	98	-859789	112	-1209564
57	-230731	71	-392137	85	-605919	99	-881883	113	-1238322
58	-240659	72	-405585	86	-623414	100	-904380	114	-1267667
59	-250826	73	-419301	87	-641230	101	-927282	115	-1297618
60	-261235	74	-433286	88	-659370	102	-950614	116	-1328195
61	-271886	75	-447546	89	-677839	103	-974377	117	-1359423
62	-282780	76	-462082	90	-696630	104	-998583	118	-1391325
63	-293921	77	-476899	91	-715772	105	-1023242		
64	-305310	78	-492000	92	-735255	106	-1048355		
65	-316949	79	-507384	93	-755096	107	-1073951		
66	-328838	80	-523060	94	-775291	108	-1100036		

The ground state configurations used for each atomic number are reported in Table 1.

Table 54

Total binding energy (DF) of the isoelectronic series of xenon (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
54	-202382	67	-341244	80	-523779	93	-756469	106	-1050583
55	-211610	68	-353672	81	-539791	94	-776723	107	-1076253
56	-221076	69	-366359	82	-556102	95	-797342	108	-1102414
57	-230780	70	-379307	83	-572716	96	-818333	109	-1129079
58	-240723	71	-392519	84	-589636	97	-839709	110	-1156264
59	-250908	72	-406000	85	-606866	98	-861467	111	-1183984
60	-261335	73	-419750	86	-624410	99	-883625	112	-1212255
61	-272005	74	-433770	87	-642277	100	-906188	113	-1241095
62	-282920	75	-448066	88	-660468	101	-929157	114	-1270522
63	-294083	76	-462639	89	-678990	102	-952557	115	-1300557
64	-305495	77	-477495	90	-697835	103	-976389	116	-1331220
65	-317159	78	-492636	91	-717032	104	-1000666	117	-1362534
66	-329073	79	-508061	92	-736571	105	-1025397	118	-1394523

The ground state configurations used for each atomic number are reported in Table 1.

Table 55

Total binding energy (DF) of the isoelectronic series of cesium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
55	-211614	68	-354014	81	-540808	94	-778709	107	-1079497
56	-221085	69	-366743	82	-557183	95	-799414	108	-1105767
57	-230798	70	-379734	83	-573863	96	-820494	109	-1132543
58	-240758	71	-392991	84	-590851	97	-841959	110	-1159840
59	-250964	72	-406518	85	-608150	98	-863809	111	-1187673
60	-261415	73	-420316	86	-625765	99	-886061	112	-1216060
61	-272111	74	-434386	87	-643705	100	-908719	113	-1245017
62	-283054	75	-448735	88	-661970	101	-931785	114	-1274564
63	-294247	76	-463362	89	-680569	102	-955283	115	-1304719
64	-305691	77	-478273	90	-699492	103	-979216	116	-1335504
65	-317388	78	-493471	91	-718769	104	-1003594	117	-1366942
66	-329339	79	-508955	92	-738389	105	-1028429	118	-1399058
67	-341547	80	-524733	93	-758370	106	-1053720		

The ground state configurations used for each atomic number are reported in Table 1.

Table 56

Total binding energy (DF) of the isoelectronic series of barium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
56	-221089	69	-367090	82	-558210	95	-801414	108	-1109030
57	-230808	70	-380123	83	-574954	96	-822581	109	-1135915
58	-240777	71	-393423	84	-592009	97	-844135	110	-1163323
59	-251002	72	-406995	85	-609376	98	-866075	111	-1191269
60	-261474	73	-420841	86	-627061	99	-888419	112	-1219770
61	-272194	74	-434960	87	-645072	100	-911171	113	-1248843
62	-283163	75	-449359	88	-663410	101	-934332	114	-1278507
63	-294384	76	-464038	89	-682083	102	-957927	115	-1308782
64	-305858	77	-479003	90	-701083	103	-981959	116	-1339688
65	-317588	78	-494257	91	-720438	104	-1006438	117	-1371249
66	-329573	79	-509799	92	-740139	105	-1031375	118	-1403489
67	-341817	80	-525636	93	-760202	106	-1056771		
68	-354322	81	-541772	94	-780624	107	-1082653		

The ground state configurations used for each atomic number are reported in Table 1.

Table 57

Total binding energy (DF) of the isoelectronic series of lanthanum (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
57	-230813	70	-380475	83	-575988	96	-824592	109	-1139193
58	-240788	71	-393817	84	-593108	97	-846234	110	-1166711
59	-251021	72	-407432	85	-610542	98	-868263	111	-1194768
60	-261513	73	-421323	86	-628295	99	-890697	112	-1223382
61	-272255	74	-435489	87	-646376	100	-913542	113	-1252569
62	-283248	75	-449938	88	-664786	101	-936797	114	-1282349
63	-294496	76	-464667	89	-683533	102	-960488	115	-1312742
64	-305998	77	-479685	90	-702607	103	-984617	116	-1343768
65	-317758	78	-494993	91	-722039	104	-1009195	117	-1375450
66	-329775	79	-510591	92	-741819	105	-1034233	118	-1407812
67	-342054	80	-526487	93	-761962	106	-1059731		
68	-354595	81	-542683	94	-782466	107	-1085718		
69	-367402	82	-559182	95	-803340	108	-1112201		

The ground state configurations used for each atomic number are reported in Table 1.

Table 58

Total binding energy (DF) of the isoelectronic series of cerium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
58	-240792	71	-394170	84	-594146	97	-848251	110	-1169997
59	-251031	72	-407828	85	-611645	98	-870368	111	-1198164
60	-261533	73	-421762	86	-629464	99	-892891	112	-1226889
61	-272294	74	-435974	87	-647614	100	-915826	113	-1256190
62	-283310	75	-450470	88	-666094	101	-939174	114	-1286084
63	-294581	76	-465249	89	-684913	102	-962959	115	-1316593
64	-306110	77	-480317	90	-704061	103	-987184	116	-1347737
65	-317899	78	-495678	91	-723569	104	-1011860	117	-1379539
66	-329947	79	-511331	92	-743425	105	-1036997	118	-1412023
67	-342258	80	-527282	93	-763647	106	-1062596		
68	-354834	81	-543536	94	-784232	107	-1088686		
69	-367677	82	-560095	95	-805188	108	-1115273		
70	-380788	83	-576963	96	-826524	109	-1142372		

The ground state configurations used for each atomic number are reported in Table 1.

Table 59

Total binding energy (DF) of the isoelectronic series of praseodymium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
59	-251036	71	-394484	83	-577881	95	-806962	107	-1091563
60	-261543	72	-408183	84	-595126	96	-828380	108	-1118254
61	-272314	73	-422160	85	-612688	97	-850192	109	-1145458
62	-283349	74	-436415	86	-630573	98	-872394	110	-1173189
63	-294643	75	-450957	87	-648790	99	-895006	111	-1201464
64	-306196	76	-465783	88	-667339	100	-918030	112	-1230299
65	-318011	77	-480901	89	-686228	101	-941469	113	-1259711
66	-330088	78	-496313	90	-705448	102	-965347	114	-1289719
67	-342430	79	-512019	91	-725030	103	-989666	115	-1320343
68	-355039	80	-528025	92	-744961	104	-1014438	116	-1351603
69	-367916	81	-544336	93	-765261	105	-1039674	117	-1383524
70	-381064	82	-560953	94	-785925	106	-1065372	118	-1416128

The ground state configurations used for each atomic number are reported in Table 1.

Table 60

Total binding energy (DF) of the isoelectronic series of neodymium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
60	-261547	72	-408501	84	-596052	96	-830167	108	-1121149
61	-272324	73	-422519	85	-613676	97	-852062	109	-1148456
62	-283370	74	-436817	86	-631625	98	-874349	110	-1176292
63	-294683	75	-451403	87	-649908	99	-897046	111	-1204674
64	-306259	76	-466275	88	-668524	100	-920159	112	-1233618
65	-318099	77	-481442	89	-687482	101	-943688	113	-1263140
66	-330203	78	-496903	90	-706774	102	-967657	114	-1293260
67	-342574	79	-512661	91	-726428	103	-992070	115	-1323997
68	-355213	80	-528720	92	-746434	104	-1016936	116	-1355373
69	-368124	81	-545086	93	-766809	105	-1042268	117	-1387410
70	-381307	82	-561760	94	-787551	106	-1068065	118	-1420133
71	-394764	83	-578747	95	-808668	107	-1094356		

The ground state configurations used for each atomic number are reported in Table 1.

Table 61

Total binding energy (DF) of the isoelectronic series of promethium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
61	-272329	73	-422840	85	-614600	97	-853835	109	-1151320
62	-283380	74	-437179	86	-632611	98	-876203	110	-1179259
63	-294706	75	-451807	87	-650956	99	-898985	111	-1207744
64	-306302	76	-466724	88	-669637	100	-922182	112	-1236792
65	-318164	77	-481936	89	-688662	101	-945798	113	-1266421
66	-330292	78	-497446	90	-708021	102	-969856	114	-1296649
67	-342691	79	-513252	91	-727745	103	-994359	115	-1327496
68	-355360	80	-529363	92	-747823	104	-1019317	116	-1358984
69	-368302	81	-545781	93	-768272	105	-1044742	117	-1391134
70	-381517	82	-562510	94	-789089	106	-1070635	118	-1423971
71	-395010	83	-579553	95	-810282	107	-1097022		
72	-408784	84	-596916	96	-831860	108	-1123913		

The ground state configurations used for each atomic number are reported in Table 1.

Table 62

Total binding energy (DF) of the isoelectronic series of samarium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
62	-283385	74	-437494	86	-633535	98	-877986	110	-1182138
63	-294716	75	-452163	87	-651942	99	-900849	111	-1210725
64	-306321	76	-467122	88	-670688	100	-924131	112	-1239877
65	-318200	77	-482379	89	-689778	101	-947832	113	-1269611
66	-330350	78	-497935	90	-709205	102	-971977	114	-1299946
67	-342774	79	-513789	91	-728998	103	-996569	115	-1330901
68	-355469	80	-529950	92	-749146	104	-1021618	116	-1362499
69	-368440	81	-546420	93	-769667	105	-1047136	117	-1394761
70	-381687	82	-563203	94	-790558	106	-1073122	118	-1427712
71	-395213	83	-580301	95	-811827	107	-1099605		
72	-409022	84	-597721	96	-833483	108	-1126593		
73	-423116	85	-615464	97	-855536	109	-1154099		

The ground state configurations used for each atomic number are reported in Table 1.

Table 63

Total binding energy (DF) of the isoelectronic series of europium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
63	-294721	75	-452482	87	-652874	99	-902641	111	-1213617
64	-306333	76	-467482	88	-671682	100	-926006	112	-1242871
65	-318218	77	-482782	89	-690836	101	-949791	113	-1272710
66	-330388	78	-498383	90	-710329	102	-974022	114	-1303150
67	-342834	79	-514284	91	-730189	103	-998701	115	-1334213
68	-355554	80	-530494	92	-750407	104	-1023840	116	-1365919
69	-368553	81	-547014	93	-770999	105	-1049448	117	-1398292
70	-381829	82	-563848	94	-791962	106	-1075527	118	-1431355
71	-395386	83	-581000	95	-813306	107	-1102104		
72	-409229	84	-598476	96	-835037	108	-1129188		
73	-423358	85	-616276	97	-857168	109	-1156791		
74	-437773	86	-634406	98	-879697	110	-1184929		

The ground state configurations used for each atomic number are reported in Table 1.

Table 64

Total binding energy (DF) of the isoelectronic series of gadolinium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
64	-306337	75	-452764	86	-635223	97	-858730	108	-1131697
65	-318228	76	-467805	87	-653750	98	-881336	109	-1159396
66	-330408	77	-483146	88	-672618	99	-904360	110	-1187632
67	-342873	78	-498789	89	-691835	100	-927805	111	-1216419
68	-355616	79	-514736	90	-711393	101	-951674	112	-1245774
69	-368640	80	-530992	91	-731319	102	-975989	113	-1275715
70	-381943	81	-547561	92	-751604	103	-1000755	114	-1306260
71	-395530	82	-564446	93	-772266	104	-1025981	115	-1337428
72	-409405	83	-581650	94	-793300	105	-1051679	116	-1369242
73	-423567	84	-599179	95	-814716	106	-1077849	117	-1401724
74	-438018	85	-617035	96	-836522	107	-1104519	118	-1434897

The ground state configurations used for each atomic number are reported in Table 1.

Table 65

Total binding energy (DF) of the isoelectronic series of terbium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
65	-318233	76	-468088	87	-654569	98	-882901	109	-1161910
66	-330418	77	-483468	88	-673497	99	-906003	110	-1190242
67	-342891	78	-499154	89	-692775	100	-929528	111	-1219127
68	-355655	79	-515144	90	-712395	101	-953478	112	-1248582
69	-368701	80	-531445	91	-732385	102	-977876	113	-1278623
70	-382030	81	-548061	92	-752737	103	-1002726	114	-1309271
71	-395645	82	-564994	93	-773466	104	-1028039	115	-1340544
72	-409549	83	-582249	94	-794570	105	-1053825	116	-1372464
73	-423743	84	-599831	95	-816058	106	-1080084	117	-1405053
74	-438228	85	-617741	96	-837936	107	-1106845	118	-1438335
75	-453010	86	-635984	97	-860218	108	-1134116		

The ground state configurations used for each atomic number are reported in Table 1.

Table 66

Total binding energy (DF) of the isoelectronic series of dysprosium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
66	-330423	77	-483753	88	-674318	99	-907573	110	-1192764
67	-342902	78	-499478	89	-693656	100	-931177	111	-1221745
68	-355673	79	-515509	90	-713337	101	-955206	112	-1251298
69	-368740	80	-531854	91	-733391	102	-979686	113	-1281440
70	-382091	81	-548515	92	-753807	103	-1004620	114	-1312188
71	-395731	82	-565496	93	-774603	104	-1030017	115	-1343564
72	-409663	83	-582800	94	-795775	105	-1055889	116	-1375589
73	-423888	84	-600432	95	-817332	106	-1082237	117	-1408284
74	-438404	85	-618395	96	-839282	107	-1109088	118	-1441674
75	-453220	86	-636692	97	-861637	108	-1136450		
76	-468334	87	-655333	98	-884395	109	-1164338		

The ground state configurations used for each atomic number are reported in Table 1.

Table 67

Total binding energy (DF) of the isoelectronic series of holmium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
67	-342907	78	-499765	89	-694484	100	-932757	111	-1224280
68	-355684	79	-515836	90	-714225	101	-956865	112	-1253930
69	-368758	80	-532223	91	-734341	102	-981425	113	-1284169
70	-382131	81	-548928	92	-754820	103	-1006440	114	-1315018
71	-395794	82	-565954	93	-775681	104	-1031921	115	-1346496
72	-409752	83	-583306	94	-796919	105	-1057879	116	-1378623
73	-424004	84	-600988	95	-818545	106	-1084313	117	-1411423
74	-438551	85	-619001	96	-840565	107	-1111253	118	-1444920
75	-453399	86	-637351	97	-862992	108	-1138705		
76	-468547	87	-656047	98	-885823	109	-1166684		
77	-484002	88	-675089	99	-909077	110	-1195204		

The ground state configurations used for each atomic number are reported in Table 1.

Table 68

Total binding energy (DF) of the isoelectronic series of erbium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
68	-355689	79	-516128	90	-715061	101	-958456	112	-1256479
69	-368770	80	-532555	91	-735236	102	-983095	113	-1286816
70	-382151	81	-549302	92	-755778	103	-1008191	114	-1317763
71	-395835	82	-566373	93	-776702	104	-1033754	115	-1349341
72	-409816	83	-583770	94	-798006	105	-1059795	116	-1381570
73	-424095	84	-601499	95	-819698	106	-1086315	117	-1414474
74	-438670	85	-619562	96	-841788	107	-1113342	118	-1448076
75	-453548	86	-637964	97	-864285	108	-1140883		
76	-468729	87	-656713	98	-887188	109	-1168952		
77	-484218	88	-675809	99	-910515	110	-1197564		
78	-500018	89	-695262	100	-934271	111	-1226734		

The ground state configurations used for each atomic number are reported in Table 1.

Table 69

Total binding energy (DF) of the isoelectronic series of thullium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
69	-368775	79	-516295	89	-695732	99	-911410	109	-1170391
70	-382163	80	-532747	90	-715569	100	-935215	110	-1199064
71	-395855	81	-549520	91	-735782	101	-959450	111	-1228296
72	-409849	82	-566618	92	-756363	102	-984140	112	-1258104
73	-424142	83	-584044	93	-777328	103	-1009289	113	-1288506
74	-438733	84	-601803	94	-798674	104	-1034905	114	-1319519
75	-453630	85	-619897	95	-820409	105	-1061002	115	-1351164
76	-468830	86	-638331	96	-842543	106	-1087578	116	-1383461
77	-484340	87	-657113	97	-865085	107	-1114662	117	-1416434
78	-500162	88	-676244	98	-888035	108	-1142262	118	-1450107

The ground state configurations used for each atomic number are reported in Table 1.

Table 70

Total binding energy (DF) of the isoelectronic series of ytterbium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
70	-382168	80	-532920	90	-716049	100	-936124	110	-1200521
71	-395868	81	-549718	91	-736300	101	-960408	111	-1229815
72	-409870	82	-566842	92	-756920	102	-985150	112	-1259686
73	-424177	83	-584296	93	-777924	103	-1010350	113	-1290151
74	-438784	84	-602084	94	-799311	104	-1036019	114	-1321229
75	-453697	85	-620208	95	-821089	105	-1062170	115	-1352940
76	-468915	86	-638673	96	-843266	106	-1088801	116	-1385305
77	-484445	87	-657488	97	-865853	107	-1115942	117	-1418347
78	-500288	88	-676653	98	-888849	108	-1143600	118	-1452090
79	-516444	89	-696176	99	-912271	109	-1171788		

The ground state configurations used for each atomic number are reported in Table 1.

Table 71

Total binding energy (DF) of the isoelectronic series of lutetium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
71	-395872	81	-549895	91	-736788	101	-961328	111	-1231287
72	-409883	82	-567045	92	-757445	102	-986119	112	-1261220
73	-424200	83	-584525	93	-778489	103	-1011370	113	-1291748
74	-438820	84	-602341	94	-799916	104	-1037092	114	-1322891
75	-453749	85	-620495	95	-821735	105	-1063296	115	-1354667
76	-468985	86	-638990	96	-843955	106	-1089982	116	-1387099
77	-484534	87	-657837	97	-866586	107	-1117179	117	-1420209
78	-500397	88	-677035	98	-889627	108	-1144894	118	-1454020
79	-516574	89	-696592	99	-913095	109	-1173140		
80	-533073	90	-716500	100	-936995	110	-1201933		

The ground state configurations used for each atomic number are reported in Table 1.

Table 72

Total binding energy (DF) of the isoelectronic series of hafnium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
72	-409889	82	-567227	92	-757942	102	-987053	112	-1262540
73	-424214	83	-584733	93	-779024	103	-1012355	113	-1293121
74	-438845	84	-602576	94	-800491	104	-1038128	114	-1324317
75	-453788	85	-620758	95	-822351	105	-1064385	115	-1356348
76	-469040	86	-639283	96	-844612	106	-1091125	116	-1388846
77	-484606	87	-658161	97	-867286	107	-1118376	117	-1422023
78	-500488	88	-677391	98	-890371	108	-1146147	118	-1455903
79	-516686	89	-696982	99	-913885	109	-1174306		
80	-533207	90	-716924	100	-937832	110	-1203302		
81	-550053	91	-737248	101	-962213	111	-1232555		

The ground state configurations used for each atomic number are reported in Table 1.

Table 73

Total binding energy (DF) of the isoelectronic series of tantalum (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
73	-424220	83	-584916	93	-779519	103	-1013277	113	-1294765
74	-438860	84	-602785	94	-801023	104	-1039100	114	-1325854
75	-453815	85	-620994	95	-822922	105	-1065407	115	-1357747
76	-469081	86	-639547	96	-845223	106	-1092198	116	-1390297
77	-484663	87	-658454	97	-867938	107	-1119502	117	-1423527
78	-500563	88	-677715	98	-891066	108	-1147327	118	-1457461
79	-516780	89	-697337	99	-914623	109	-1175685		
80	-533321	90	-717313	100	-938614	110	-1204592		
81	-550188	91	-737671	101	-963041	111	-1234064		
82	-567385	92	-758400	102	-987928	112	-1264115		

The ground state configurations used for each atomic number are reported in Table 1.

Table 74

Total binding energy (DF) of the isoelectronic series of tungsten (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
74	-438866	83	-585077	92	-758831	101	-963835	110	-1205291
75	-453830	84	-602971	93	-779985	102	-988768	111	-1234798
76	-469106	85	-621206	94	-801526	103	-1014165	112	-1264885
77	-484703	86	-639787	95	-823463	104	-1040036	113	-1295571
78	-500619	87	-658723	96	-845803	105	-1066392	114	-1326874
79	-516854	88	-678014	97	-868559	106	-1093234	115	-1359477
80	-533415	89	-697667	98	-891728	107	-1120590	116	-1392099
81	-550304	90	-717675	99	-915328	108	-1148467	117	-1425402
82	-567523	91	-738066	100	-939363	109	-1176880	118	-1459411

The ground state configurations used for each atomic number are reported in Table 1.

Table 75

Total binding energy (DF) of the isoelectronic series of rhenium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
75	-453836	84	-603137	93	-780423	102	-989573	111	-1236634
76	-469122	85	-621398	94	-802000	103	-1014311	112	-1266800
77	-484731	86	-640005	95	-823974	104	-1040935	113	-1297566
78	-500662	87	-658968	96	-846353	105	-1067340	114	-1328951
79	-516914	88	-678288	97	-869149	106	-1093428	115	-1360974
80	-533493	89	-697972	98	-892358	107	-1121639	116	-1393658
81	-550402	90	-718011	99	-916000	108	-1149568	117	-1427023
82	-567643	91	-738435	100	-940079	109	-1178034	118	-1461096
83	-585220	92	-759233	101	-964595	110	-1207051		

The ground state configurations used for each atomic number are reported in Table 1.

Table 76

Total binding energy (DF) of the isoelectronic series of osmium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
76	-469128	85	-621567	94	-802444	103	-1015830	112	-1268076
77	-484747	86	-640200	95	-824455	104	-1041795	113	-1298899
78	-500691	87	-659190	96	-846871	105	-1068248	114	-1330342
79	-516959	88	-678538	97	-869706	106	-1095189	115	-1362425
80	-533555	89	-698251	98	-892955	107	-1122647	116	-1395168
81	-550482	90	-718321	99	-916638	108	-1150628	117	-1428595
82	-567743	91	-738777	100	-940759	109	-1179146	118	-1462730
83	-585342	92	-759608	101	-965318	110	-1208216		
84	-603283	93	-780831	102	-990341	111	-1237854		

The ground state configurations used for each atomic number are reported in Table 1.

Table 77

Total binding energy (DF) of the isoelectronic series of iridium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
77	-484754	86	-640374	95	-824906	104	-1042620	113	-1300189
78	-500708	87	-659390	96	-847360	105	-1069120	114	-1331690
79	-516989	88	-678765	97	-870232	106	-1096110	115	-1363831
80	-533601	89	-698506	98	-893521	107	-1123616	116	-1396634
81	-550546	90	-718606	99	-917244	108	-1151648	117	-1430122
82	-567826	91	-739093	100	-941406	109	-1180218	118	-1464319
83	-585445	92	-759956	101	-966008	110	-1209341		
84	-603408	93	-781213	102	-991075	111	-1239033		
85	-621716	94	-802860	103	-1016609	112	-1269310		

The ground state configurations used for each atomic number are reported in Table 1.

Table 78

Total binding energy (DF) of the isoelectronic series of platinum (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
78	-500715	87	-659569	96	-847820	105	-1069958	114	-1332996
79	-517008	88	-678970	97	-870729	106	-1096995	115	-1365195
80	-533634	89	-698739	98	-894057	107	-1124550	116	-1398057
81	-550595	90	-718868	99	-917820	108	-1152632	117	-1431605
82	-567893	91	-739385	100	-942022	109	-1181253	118	-1465863
83	-585532	92	-760279	101	-966667	110	-1210428		
84	-603516	93	-781568	102	-991776	111	-1240173		
85	-621846	94	-803249	103	-1017354	112	-1270504		
86	-640528	95	-825330	104	-1043411	113	-1301439		

The ground state configurations used for each atomic number are reported in Table 1.

Table 79

Total binding energy (DF) of the isoelectronic series of gold (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
79	-517015	87	-659689	95	-825635	103	-1017909	111	-1241050
80	-533651	88	-679110	96	-848152	104	-1044002	112	-1271427
81	-550623	89	-698900	97	-871090	105	-1070587	113	-1302409
82	-567934	90	-719049	98	-894447	106	-1097662	114	-1334014
83	-585586	91	-739588	99	-918241	107	-1125257	115	-1366263
84	-603585	92	-760506	100	-942475	108	-1153379	116	-1399176
85	-621931	93	-781820	101	-967153	109	-1182042	117	-1432776
86	-640630	94	-803527	102	-992296	110	-1211261	118	-1467087

The ground state configurations used for each atomic number are reported in Table 1.

Table 80

Total binding energy (DF) of the isoelectronic series of mercury (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
80	-533660	88	-679234	96	-848463	104	-1044568	112	-1272319
81	-550642	89	-699044	97	-871429	105	-1071189	113	-1303347
82	-567964	90	-719214	98	-894815	106	-1098302	114	-1335000
83	-585629	91	-739775	99	-918639	107	-1125936	115	-1367297
84	-603642	92	-760716	100	-942905	108	-1154099	116	-1400260
85	-622003	93	-782053	101	-967615	109	-1182803	117	-1433912
86	-640718	94	-803785	102	-992792	110	-1212064	118	-1468276
87	-659795	95	-825919	103	-1018439	111	-1241898		

The ground state configurations used for each atomic number are reported in Table 1.

Table 81

Total binding energy (DF) of the isoelectronic series of thallium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
81	-550647	89	-699158	97	-871723	105	-1071730	113	-1304209
82	-567978	90	-719347	98	-895136	106	-1098880	114	-1335907
83	-585654	91	-739928	99	-918989	107	-1126551	115	-1368251
84	-603678	92	-760889	100	-943284	108	-1154751	116	-1401262
85	-622053	93	-782249	101	-968024	109	-1183495	117	-1434963
86	-640782	94	-804004	102	-993232	110	-1212797	118	-1469378
87	-659875	95	-826161	103	-1018912	111	-1242672		
88	-679331	96	-848731	104	-1045075	112	-1273136		

The ground state configurations used for each atomic number are reported in Table 1.

Table 82

Total binding energy (DF) of the isoelectronic series of lead (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
82	-567985	90	-719465	98	-895437	106	-1099431	114	-1336782
83	-585670	91	-740065	99	-919317	107	-1127139	115	-1369173
84	-603705	92	-761047	100	-943641	108	-1155377	116	-1402231
85	-622092	93	-782428	101	-968410	109	-1184159	117	-1435981
86	-640835	94	-804204	102	-993650	110	-1213501	118	-1470446
87	-659942	95	-826386	103	-1019362	111	-1243417		
88	-679413	96	-848979	104	-1045557	112	-1273924		
89	-699257	97	-871997	105	-1072247	113	-1305039		

The ground state configurations used for each atomic number are reported in Table 1.

Table 83

Total binding energy (DF) of the isoelectronic series of bismuth (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
83	-585676	91	-740176	99	-919598	107	-1127645	115	-1369958
84	-603720	92	-761176	100	-943947	108	-1155915	116	-1403055
85	-622117	93	-782576	101	-968742	109	-1184730	117	-1436844
86	-640872	94	-804373	102	-994008	110	-1214105	118	-1471350
87	-659992	95	-826575	103	-1019748	111	-1244055		
88	-679477	96	-849190	104	-1045972	112	-1274598		
89	-699336	97	-872230	105	-1072691	113	-1305750		
90	-719560	98	-895694	106	-1099906	114	-1337530		

The ground state configurations used for each atomic number are reported in Table 1.

Table 84

Total binding energy (DF) of the isoelectronic series of polonium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
84	-603728	91	-740275	98	-895933	105	-1073115	112	-1275247
85	-622134	92	-761292	99	-919861	106	-1100359	113	-1306435
86	-640899	93	-782710	100	-944234	107	-1128128	114	-1338251
87	-660031	94	-804526	101	-969055	108	-1156430	115	-1370717
88	-679530	95	-826748	102	-994348	109	-1185277	116	-1403852
89	-699403	96	-849384	103	-1020115	110	-1214686	117	-1437680
90	-719642	97	-872447	104	-1046367	111	-1244670	118	-1472226

The ground state configurations used for each atomic number are reported in Table 1.

Table 85

Total binding energy (DF) of the isoelectronic series of astatine (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
85	-622143	92	-761393	99	-920104	106	-1100789	113	-1307093
86	-640917	93	-782829	100	-944502	107	-1128588	114	-1338946
87	-660060	94	-804663	101	-969348	108	-1156921	115	-1371448
88	-679571	95	-826905	102	-994666	109	-1185800	116	-1404621
89	-699458	96	-849562	103	-1020460	110	-1215241	117	-1438488
90	-719711	97	-872645	104	-1046739	111	-1245259	118	-1473073
91	-740360	98	-896154	105	-1073516	112	-1275870		

The ground state configurations used for each atomic number are reported in Table 1.

Table 86

Total binding energy (DF) of the isoelectronic series of radon (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
86	-640927	93	-782934	100	-944752	107	-1129027	114	-1339615
87	-660080	94	-804787	101	-969622	108	-1157390	115	-1372153
88	-679602	95	-827047	102	-994966	109	-1186300	116	-1405363
89	-699502	96	-849724	103	-1020786	110	-1215773	117	-1439268
90	-719769	97	-872828	104	-1047092	111	-1245824	118	-1473892
91	-740432	98	-896358	105	-1073896	112	-1276469		
92	-761482	99	-920331	106	-1101198	113	-1307727		

The ground state configurations used for each atomic number are reported in Table 1.

Table 87

Total binding energy (DF) of the isoelectronic series of francium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
87	-660083	94	-804889	101	-969911	108	-1157926	115	-1372993
88	-679612	95	-827172	102	-995286	109	-1186876	116	-1406252
89	-699518	96	-849872	103	-1021139	110	-1216390	117	-1440206
90	-719796	97	-873002	104	-1047479	111	-1246484	118	-1474880
91	-740475	98	-896559	105	-1074319	112	-1277172		
92	-761543	99	-920560	106	-1101658	113	-1308474		
93	-783015	100	-945010	107	-1129524	114	-1340408		

The ground state configurations used for each atomic number are reported in Table 1.

Table 88

Total binding energy (DF) of the isoelectronic series of radium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
88	-679616	95	-827278	102	-995581	109	-1187420	116	-1407102
89	-699529	96	-850001	103	-1021465	110	-1216975	117	-1441105
90	-719814	97	-873155	104	-1047839	111	-1247109	118	-1475828
91	-740505	98	-896738	105	-1074713	112	-1277841		
92	-761589	99	-920766	106	-1102087	113	-1309187		
93	-783080	100	-945244	107	-1129991	114	-1341165		
94	-804973	101	-970175	108	-1158430	115	-1373797		

The ground state configurations used for each atomic number are reported in Table 1.

Table 89

Total binding energy (DF) of the isoelectronic series of actinium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
89	-699533	95	-827365	101	-970413	107	-1130427	113	-1309863
90	-719825	96	-850110	102	-995849	108	-1158903	114	-1341886
91	-740523	97	-873287	103	-1021765	109	-1187932	115	-1374562
92	-761620	98	-896894	104	-1048171	110	-1217525	116	-1407914
93	-783128	99	-920949	105	-1075078	111	-1247701	117	-1441964
94	-805040	100	-945454	106	-1102487	112	-1278474	118	-1476736

The ground state configurations used for each atomic number are reported in Table 1.

Table 90

Total binding energy (DF) of the isoelectronic series of thorium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
90	-719830	96	-850199	102	-996090	108	-1159343	114	-1342567
91	-740534	97	-873398	103	-1022036	109	-1188409	115	-1375288
92	-761639	98	-897028	104	-1048473	110	-1218041	116	-1408685
93	-783160	99	-921107	105	-1075413	111	-1248256	117	-1442782
94	-805089	100	-945639	106	-1102856	112	-1279070	118	-1477602
95	-827433	101	-970626	107	-1130830	113	-1310501		

The ground state configurations used for each atomic number are reported in Table 1.

Table 91

Total binding energy (DF) of the isoelectronic series of protactinium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
91	-740538	97	-873488	103	-1022280	109	-1188854	115	-1375976
92	-761650	98	-897141	104	-1048748	110	-1218524	116	-1409418
93	-783179	99	-921244	105	-1075720	111	-1248778	117	-1443560
94	-805122	100	-945801	106	-1103195	112	-1279632	118	-1478427
95	-827483	101	-970813	107	-1131204	113	-1311103		
96	-850268	102	-996306	108	-1159752	114	-1343212		

The ground state configurations used for each atomic number are reported in Table 1.

Table 92

Total binding energy (DF) of the isoelectronic series of uranium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
92	-761653	98	-897232	104	-1048992	110	-1218966	116	-1410100
93	-783189	99	-921357	105	-1075994	111	-1249257	117	-1444286
94	-805140	100	-945937	106	-1103501	112	-1280149	118	-1479198
95	-827517	101	-970975	107	-1131541	113	-1311660		
96	-850319	102	-996493	108	-1160123	114	-1343809		
97	-873558	103	-1022496	109	-1189260	115	-1376615		

The ground state configurations used for each atomic number are reported in Table 1.

Table 93

Total binding energy (DF) of the isoelectronic series of neptunium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
93	-783195	99	-921454	105	-1076248	111	-1249716	117	-1444993
94	-805153	100	-946057	106	-1103786	112	-1280646	118	-1479950
95	-827539	101	-971119	107	-1131859	113	-1312197		
96	-850357	102	-996663	108	-1160474	114	-1344387		
97	-873614	103	-1022693	109	-1189646	115	-1377235		
98	-897307	104	-1049217	110	-1219388	116	-1410762		

The ground state configurations used for each atomic number are reported in Table 1.

Table 94

Total binding energy (DF) of the isoelectronic series of plutonium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
94	-805157	99	-921525	104	-1049410	109	-1189992	114	-1344917
95	-827550	100	-946150	105	-1076469	110	-1219768	115	-1377805
96	-850376	101	-971234	106	-1104037	111	-1250132	116	-1411374
97	-873648	102	-996803	107	-1132140	112	-1281100	117	-1445647
98	-897359	103	-1022858	108	-1160788	113	-1312688	118	-1480648

The ground state configurations used for each atomic number are reported in Table 1.

Table 95

Total binding energy (DF) of the isoelectronic series of americium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
95	-827554	100	-946224	105	-1076665	110	-1220120	115	-1378342
96	-850388	101	-971330	106	-1104261	111	-1250518	116	-1411951
97	-873667	102	-996922	107	-1132395	112	-1281522	117	-1446266
98	-897394	103	-1023001	108	-1161073	113	-1313147	118	-1481309
99	-921579	104	-1049579	109	-1190310	114	-1345414		

The ground state configurations used for each atomic number are reported in Table 1.

Table 96

Total binding energy (DF) of the isoelectronic series of curium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
96	-850393	101	-971406	106	-1104461	111	-1250874	116	-1412493
97	-873679	102	-997019	107	-1132623	112	-1281912	117	-1446848
98	-897415	103	-1023122	108	-1161331	113	-1313574	118	-1481933
99	-921616	104	-1049725	109	-1190599	114	-1345878		
100	-946279	105	-1076837	110	-1220442	115	-1378844		

The ground state configurations used for each atomic number are reported in Table 1.

Table 97

Total binding energy (DF) of the isoelectronic series of berkelium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
97	-873683	102	-997093	107	-1132821	112	-1282267	117	-1447390
98	-897426	103	-1023218	108	-1161558	113	-1313964	118	-1482516
99	-921634	104	-1049844	109	-1190856	114	-1346304		
100	-946314	105	-1076982	110	-1220730	115	-1379307		
101	-971460	106	-1104631	111	-1251195	116	-1412995		

The ground state configurations used for each atomic number are reported in Table 1.

Table 98

Total binding energy (DF) of the isoelectronic series of californium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
98	-897431	103	-1023298	108	-1161764	113	-1314329	118	-1483070
99	-921648	104	-1049946	109	-1191092	114	-1346704		
100	-946337	105	-1077108	110	-1220996	115	-1379744		
101	-971500	106	-1104783	111	-1251493	116	-1413470		
102	-997153	107	-1132999	112	-1282598	117	-1447903		

The ground state configurations used for each atomic number are reported in Table 1.

Table 99

Total binding energy (DF) of the isoelectronic series of einsteinium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy	Z	Energy
99	-921653	103	-1023354	107	-1133147	111	-1251754	115	-1380138
100	-946349	104	-1050023	108	-1161938	112	-1282890	116	-1413900
101	-971520	105	-1077207	109	-1191294	113	-1314654	117	-1448371
102	-997190	106	-1104905	110	-1221227	114	-1347063	118	-1483576

The ground state configurations used for each atomic number are reported in Table 1.

Table 100

Total binding energy (DF) of the isoelectronic series of fermium (eV). See page 124 for Explanation of Tables

Z	Energy								
100	-946354	104	-1050087	108	-1162098	112	-1283168	116	-1414317
101	-971534	105	-1077293	109	-1191481	113	-1314965	117	-1448826
102	-997216	106	-1105014	110	-1221443	114	-1347408	118	-1484069
103	-1023399	107	-1133281	111	-1252000	115	-1380519		

The ground state configurations used for each atomic number are reported in Table 1.

Table 101

Total binding energy (DF) of the isoelectronic series of mendelevium (eV). See page 124 for Explanation of Tables

Z	Energy								
101	-971539	105	-1077336	109	-1191590	113	-1315155	117	-1449113
102	-997228	106	-1105073	110	-1221571	114	-1347622	118	-1484383
103	-1023419	107	-1133355	111	-1252148	115	-1380756		
104	-1050118	108	-1162189	112	-1283337	116	-1414579		

The ground state configurations used for each atomic number are reported in Table 1.

Table 102

Total binding energy (DF) of the isoelectronic series of nobelium (eV). See page 124 for Explanation of Tables

Z	Energy								
102	-997233	106	-1105119	110	-1221684	114	-1347817	118	-1484677
103	-1023432	107	-1133416	111	-1252280	115	-1380975		
104	-1050140	108	-1162266	112	-1283489	116	-1414822		
105	-1077369	109	-1191684	113	-1315329	117	-1449381		

The ground state configurations used for each atomic number are reported in Table 1.

Table 103

Total binding energy (DF) of the isoelectronic series of lawrencium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy
103	-1023437	107	-1133461	111	-1252381	115	-1381147
104	-1050153	108	-1162324	112	-1283607	116	-1415014
105	-1077392	109	-1191756	113	-1315464	117	-1449594
106	-1105153	110	-1221770	114	-1347971	118	-1484912

The ground state configurations used for each atomic number are reported in Table 1.

Table 104

Total binding energy (DF) of the isoelectronic series of rutherfordium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy
104	-1050158	108	-1162379	112	-1283743	116	-1415248
105	-1077406	109	-1191829	113	-1315623	117	-1449856
106	-1105178	110	-1221863	114	-1348154	118	-1485202
107	-1133500	111	-1252495	115	-1381355		

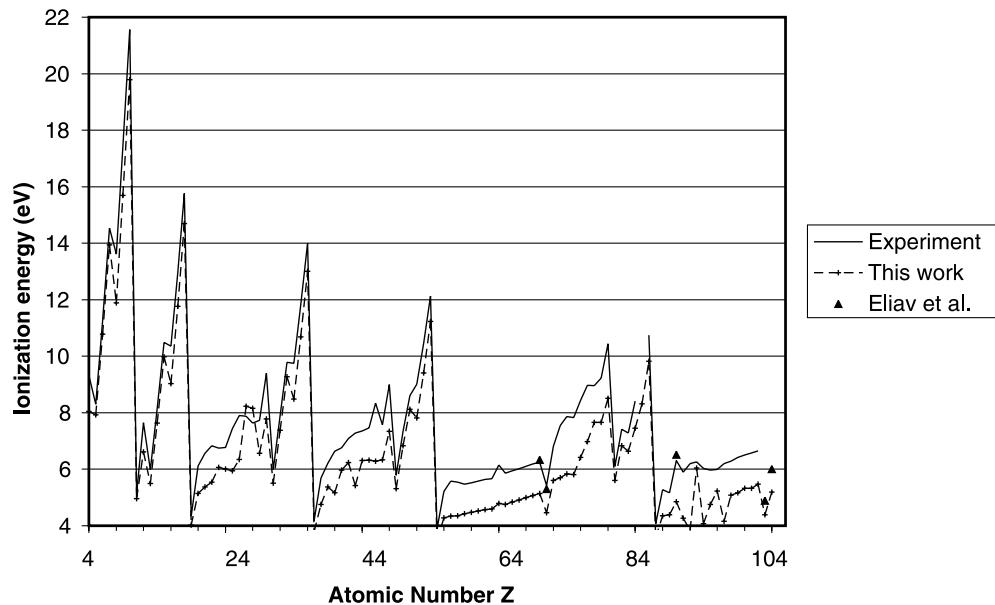
The ground state configurations used for each atomic number are reported in Table 1.

Table 105

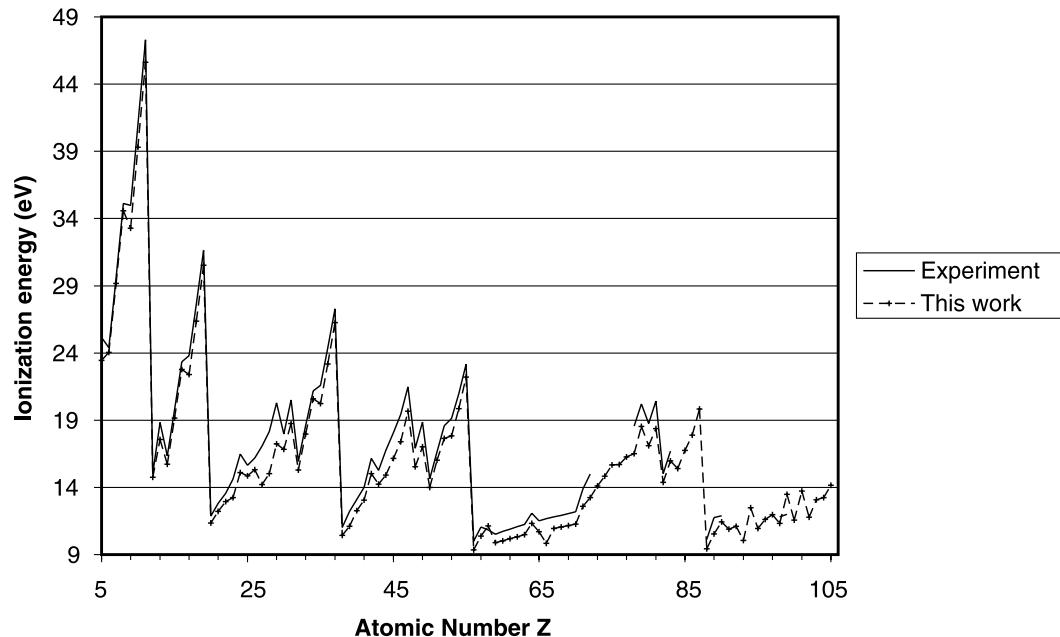
Total binding energy (DF) of the isoelectronic series of dubnium (eV). See page 124 for Explanation of Tables

Z	Energy	Z	Energy	Z	Energy	Z	Energy
105	-1077412	109	-1191879	113	-1315740	117	-1450056
106	-1105192	110	-1221928	114	-1348290	118	-1485425
107	-1133525	111	-1252576	115	-1381512		
108	-1162416	112	-1283841	116	-1415426		

The ground state configurations used for each atomic number are reported in Table 1.



Graph 1. Comparison between experiment as reported in [16] and theory for the ionization energy of neutral atoms. Eliav et al.: Relativistic coupled cluster calculations from [17,18]. See page 125 for Explanation of Graphs.



Graph 2. Comparison between experiment as reported in [47] and theory for the ionization energy of singly ionized atoms. Eliav et al.: Relativistic coupled cluster calculations from [17,18]. See page 125 for Explanation of Graphs.