ATOMIC ENERGY LEVELS

As Derived From the Analyses of Optical Spectra

Volume III

42Mo—57La

72Hf—89Ac

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UNITED STATES DEPARTMENT OF COMMERCE

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UNITED STATES DEPARTMENT OF COMMERCE, Sinclair Weeks, Secretary
NATIONAL BUREAU OF STANDARDS, A. V. Astin, Director

ATOMIC ENERGY LEVELS

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Volume III

The Spectra of Molybdenum, Technetium, Ruthenium, Rhodium, Palladium, Silver, Cadmium, Indium, Tin, Antimony, Tellurium, Iodine, Xenon, Cesium, Barium, Lanthanum—Hafnium, Tantalum, Tungsten, Rhenium, Osmium, Iridium, Platinum, Gold, Mercury, Thallium, Lead, Bismuth, Polonium, Radon, Radium, and Actinium

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Preface

The present Volume, including data to December 1957, is the third of a series being prepared at the National Bureau of Standards under a project on the compilation of atomic energy levels derived from the analyses of optical spectra.

Volume I, published in June 1949, contains the energy levels of 206 spectra of the elements Hydrogen through Vanadium, $Z=1$ through 23. Volume II, completed in August 1952, includes similar data for 152 spectra of the elements Chromium through Niobium, $Z=24$ through 41. Volume III covers the elements Molybdenum through Lanthanum, $Z=42$ through 57; and Hafnium through Actinium, $Z=72$ through 89. It includes 124 spectra, and is identical in arrangement with Volumes I and II. The form of presentation is that recommended by the majority of interested scientists who received a questionnaire proposed by the National Research Council Committee on Line Spectra of the Elements, when the program was started in 1946.

The manuscript has been prepared by Charlotte E. Moore under the direction of William F. Meggers, Chief of the Spectroscopy Section of the Atomic and Radiation Physics Division. The success of this project has depended heavily upon the cordial and continuing collaboration of the many spectroscopists who have made an unusual effort to furnish data in advance of publication. Their efforts together with the unfailing cooperation of the National Research Council Committee are greatly appreciated.

Perhaps the most difficult phase of this extensive program lies ahead. The two groups of rare-earth spectra (58 Cerium through 71 Lutetium, and 90 Thorium through 100 Fermium) remain for Volume IV. At best, the preparation of this Volume within the next few years will tax the most experienced and talented workers available. These spectra are the most intricate and least known of atomic spectra. Consequently the type of collaboration we have enjoyed with qualified spectroscopists in the preparation of the first three Volumes of the "Atomic Energy Levels" series will have not only to continue but be substantially augmented if the fourth Volume is to be brought to satisfactory fruition.

A. V. Astin, *Director*

Washington, D. C., July 1, 1957.

Contents

A list of additions and corrections to Volumes I and II is appended, pages 238 to 245.

List of Tables

** The two groups of rare-earth spectra, *Ce* to *Lu* (Z=58 to 71) and *Th* to *Fm* (Z=90 to 100) will be included in Vol. IV. See references to these spectra in Table 33.

Index to Spectra

Index to Spectra—Continued

1. Introduction

The present Volume is the third of a series being prepared at the National Bureau of Standards in continuation of a project started in 1946. At that time the National Research Council Committee on Line Spectra of the Elements met to discuss details regarding the preparation, in the Spectroscopy Section of this Bureau, of a critical compendium of Atomic Energy Levels. The need for such a program was stressed because Bacher and Goudsmit did not contemplate revising their very useful book on "*Atomic Energy States as Derived from the Analyses of Optical Spectra*," published in 1932. The demand for these Volumes has abundantly justified the need anticipated by the Committee in formulating and supporting this extensive project.

2. Scope of the Present Tables

This Volume covers the elements Mo to La ($Z=42$ to 57) and Hf to Ac ($Z=72$ to 89), thus completing the Periodic Table except for the two groups of rare-earth elements, which will comprise Volume IV. Pending the completion of Volume IV, which is by far the most difficult of all, a current list of references to analyses of rare-earth spectra is included here in Table 33, p. XXXIII.

In spite of requests to increase the scope of the tables it has been decided to retain the general format of Volumes I and II throughout.

As the atomic number increases, the spectra become more complex. Because of configuration-interaction and breakdown of *LS*-coupling it is increasingly difficult to make term-designation assignments that are significant. Consequently, the present Volume has many more miscellaneous levels than are found among spectra of lighter elements. It is hoped that this compendium will provide useful data for workers interested in future studies of the general problems of configuration-interaction and coupling, even though many of the spectra are incompletely analyzed.

The important subject of hyperfine structure is handled only by general references to bibliographies on the subject. In the present Volume the publications by Walchli [1][1] and by Klinkenberg [2] replace the earlier bibliographies by Mack [3] and by Meggers [4] for many spectra. In addition, selected papers are listed for a very few spectra, particularly if they do not appear in current bibliographies summarizing hyperfine-structure data. Workers in this field will find these Volumes seriously inadequate.

Since these tables do not include the lists of observed spectral lines from which the atomic energy levels are derived, the users must consult the individual papers on the analyses of the separate spectra for wavelengths, intensities, and line classifications. This difficulty is being handled, in part, by the preparation of "An Ultraviolet Multiplet Table" [5] for selected spectra. Each Volume of "Atomic Energy Levels" is accompanied by a Section of the Ultraviolet Multiplet Table covering the same range of elements. Section 3 of this Table is now in course of preparation. For multiplet data on individual spectra in the wavelength range longer than 3000A the "Revised Multiplet Table" [6] will suffice to some extent. A revision of this 1945 edition is in course of preparation.

Urgent requests for Grotrian Diagrams to accompany these tables have been met in part by the preparation of selected *Partial Grotrian Diagrams of Astrophysical Interest*, accompanied by tables of related lines in individual spectra of the isoelectronic sequences represented by the diagrams [7].

3. Arrangement

The arrangement of the data in the various columns of the table, and the notation are described in detail in Volume I, and will not be repeated here, since the same style has been followed throughout. In general, all levels of the "odd" type are printed in italics.

The letters in parentheses following the literature references have the following meaning:

IP	Ionization potential.
T	Terms.
CL	Classified lines.
GD	Grotrian diagram.
ED	Energy diagram.
ZE	Zeeman effect.
IS	Isotope shift.
hfs	Hyperfine structure.

These letters describe briefly the scope and content of the paper. If no such letters follow a reference, the paper is mentioned in the text for the spectrum in question. For example, in general no letter accompanies references to theoretical papers.

[1] Figures in brackets indicate literature references on p. IX.

4. Tables of Predicted and Observed Arrays of Terms

As in the preceding Volumes, for complex spectra whose analyses are not seriously incomplete, arrays of observed terms follow the individual listings of atomic energy levels in the table. Similar, but more extensive, arrays of terms predicted by theory for spectra of the different isoelectronic sequences are included in Tables 1 to 32 (pages XII to XXXII) as follows:

Table	Sequence	Table	Sequence	Table	Sequence	Table	Sequence
1	Mo I	9	Sn I	17	Ta I	25	Tl I
2	Tc I	10	Sb I	18	W I	26	Pb I
3	Ru I	11	Te I	19	Re I	27	Bi I
4	Rh I	12	I I	20	Os I	28	Po I
5	Pd I	13	Xe I	21	Ir I	29	At I
6	Ag I	14	Ba I	22	Pt I	30	Rn I
7	Cd I	15	La I**	23	Au I	31	Ra I
8	In I	16	Hf I	24	Hg I	32	Ac I

Leaders indicate that predicted terms from additional electrons have been omitted.

For the Xe I and Rn I sequences the tables give predicted terms (*LS*-coupling) and predicted pairs of levels (*Jl*-coupling), as has been done for the preceding spectra of the inert-gas type. The pair-coupling notation in the general form suggested by Racah [8] has been adopted as before, to take into account the departure from *LS*-coupling.

In the arrays of predicted terms the order follows in a general way that of the limit terms of the first spectrum of the sequence. Consequently, in successive Volumes the arrays are not identically arranged, since different configurations and limit-terms predominate as Z increases.

Predicted terms in configurations involving equivalent electrons are summarized in a number of general references to atomic spectra. [9]

5. The Periodic Table

5.1 The Chemical Elements by Atomic Number; Ionization Potentials (Table 34)

Requests for ionization potentials have exceeded all others for data in these Volumes. A number of those published in Volumes I and II have subsequently been revised. Ionization potentials for all spectra in Volumes I, II, and III, so far as known, are listed in Table 34, which supersedes those published earlier. Column one gives the atomic number Z; column two the chemical symbol of the element. Successive columns contain the ionization potentials of the atoms or ions in successive stages of ionization, I denoting first spectra (neutral atoms); II, second spectra (singly ionized atoms); etc.

Throughout these Volumes the ionization potentials are derived by multiplying the limit in cm^{-1} (K) by the conversion factor 0.00012395, to express it in electron volts. This factor was recommended by Birge in 1941 [10] and adopted by the Joint Commission for Spectroscopy in 1953 "to conform to the standard book 'Atomic Energy Levels'. With the 1951 values of h, c, and e the value for λ_0 is between 12396 and 12397". [11, 12]

The writer takes this opportunity to point out that she misquoted the limits for the spectra of the C I and N I sequences in Volume I. The resulting corrected ionization potentials are included both in Table 34 and in the list of corrections facing blank page 238.

Although series are not known for all the listed spectra of a given stage of ionization in the respective periods of the Periodic Table, yet it is possible to derive fairly reliable limits in cases where well established series are known for neighboring spectra. Russell has discussed this for the group of second spectra from Ca to Zn [13]. Similarly, Catalán and Velasco [14] have determined limits and ionization potentials for the first, second, and third spectra of the iron group. Catalán and Rico give similar data for the first and second spectra of the palladium group [15]. Rico has generously furnished revised values for the second spectra of this group, and for the third spectra Y III to In III, in advance of publication [16].

From a study of screening constants, Finkelnburg and Humbach have interpolated ionization potentials for the entire periodic table [17].

5.2 The Chemical Elements by Chemical Symbol (Table 35)

For convenience of cross reference, the chemical elements are listed in Table 35 in the alphabetical order of the chemical symbol. This Table is identical in form with Table 24 in Volume I, and Table 19 of Volume II. It includes the four additional elements, 99 Einsteinium, 100 Fermium, 101 Mendelevium, and 102 Nobelium, whose names have been adopted by the International Union of Pure and Applied Chemistry Commission on Nomenclature (Section of Inorganic Chemistry).

5.3 The Periodic System (Table 36)

Table 36 is identical in form with Table 25 of Volume I and Table 20 of Volume II. The general arrangement is similar to that given by Condon and Shortley on page 333 of "*The Theory of Atomic Spectra*" [18].

5.4 Index—Isoelectronic Sequences (Table 37)

This table is the index to the data in Volume III, i. e., the spectra from Mo through La and Hf through Ac, arranged similarly to the indices for Volumes I and II.

Column I gives the atomic number Z followed by the chemical symbol under the heading "Element." The remaining columns indicate the successive stages of ionization under the general heading "Spectrum," I denoting first spectra (neutral atoms), II second spectra (singly-ionized atoms), III third spectra, etc. The numbers in the body of the table indicate the page on which the data for the individual spectra may be found.

In this table, isoelectronic spectra appear on the diagonals. Alternate diagonals are printed in bold face type to emphasize the spectra of each sequence. Blanks occur for spectra in which structure is not yet known.

No isoelectronic sequences are carried into the rare-earth groups of spectra in this Volume, but they will be continued in Volume IV for the two groups of spectra of elements with $Z>57$ and $Z>89$, respectively. The isoelectronic sequences in this part of the periodic table are, in general, very short. Those started but not completed in Volume III are as follows:

Sequence	Spectrum	Sequence	Spectrum
Cs I	Ce IV	Fr I	Th IV
Ba I	Ce III	Ra I	Th III
La I	Ce II	Ac I	Th II

6. References

[1] H. E. Walchli, *A Table of Nuclear Moment Data*, Oak Ridge Nat. Lab., ORNL—1469, 134 pp. (1953); Suppl. II (Physics), 43 pp. (1955).
[2] P. F. A. Klinkenberg, Rev. Mod. Phys. **24**, No. 2, 63–73 (April 1952).
[3] J. E. Mack, Rev. Mod. Phys. **22**, No. 1, 64–76 (January 1950).
[4] W. F. Meggers, J. Opt. Soc. Am. **36**, 431–448 (August 1946).
[5] C. E. Moore, Circ. Nat. Bur. Std. 488, Section 1, H to V (1950); Section 2, Cr to Nb (1952); Section 3, Mo to La and Hf to Ac, in press (1958).
[6] C. E. Moore, Princeton Univ. Obs. Contr. No. 20 (1945).
[7] P. W. Merrill, *Lines of the Chemical Elements in Astronomical Spectra*, Appendix A, Carnegie Inst. Wash. Publ. 610, 103–165 (1956).
[8] G. Racah, Phys. Rev. **61**, 537 (L) (1942).
[9] H. N. Russell, Phys. Rev. **29**, 782 (1927); R. C. Gibbs, D. T. Wilber, and H. E. White, Phys. Rev. **29**, 790 (1927); R. F. Bacher and S. Goudsmit, *Atomic Energy States*, p. 10 (McGraw-Hill Book Co., Inc., New York and London, 1932); F. Hund, *Linienspektren und Periodisches System der Elemente* (Julius Springer, Berlin, 1927); C. L. B. Shudeman, J. Franklin Inst. **224**, 501 (1937) (Terms from equivalent *g*-, *h*-, and *i*-electrons).
[10] R. T. Birge, Rev. Mod. Phys. **13**, No. 4, 237 (1941).
[11] Trans. Joint Commission for Spectroscopy, J. Opt. Soc. Am. **43**, 412 (1953).
[12] The writer used the factor 0.00012345 in preparing the multiplet tables, which explains the discrepancies between the ionization potentials quoted in the Multiplet Tables [5,6] and those used in these Volumes.
[13] H. N. Russell, J. Opt. Soc. Am. **40**, 618, 1950.
[14] M. A. Catalán y R. Velasco, An. Real Soc. Esp. Fisica y Quimica (Madrid) [A] **48**, 247 (1952).
[15] M. A. Catalán y F. R. Rico, An. Real Soc. Esp. Fisica y Quimica (Madrid) [A] **48**, 328 (1952).
[16] F. R. Rico, unpublished material (December 1956); M. A. Catalán y F. R. Rico, An. Real Soc. Esp. Fisica y Quimica (Madrid) [A] **53**, 85 (1957).
[17] W. Finkelnburg und W. Humbach, Naturwiss. **42**, 35 (1955).
[18] E. U. Condon and G. H. Shortley, *The Theory of Atomic Spectra*, (The University Press, Cambridge, England; The Macmillan Co., N. Y., corrected edition, 1951).

7. Acknowledgments

The present Volume could not have been prepared without unrelenting effort on the part of spectroscopists at home and abroad. At the National Bureau of Standards, W. F. Meggers, Chief of the Spectroscopy Section and Chairman of the National Research Council Committee on Line Spectra of the Elements, has given generously of his time and expert advice on numerous difficult questions, and has painstakingly supervised the work throughout. He, with the assistance of his coworkers, has contributed unpublished analyses for more spectra than any other single individual, 13 spectra in all. C. C. Kiess has likewise arranged his entire schedule to fit into this program. The unpublished data from him and his colleagues on six complex spectra, have greatly enhanced the value of this Volume. His spectra start Volume III (Mo I and Mo II) as was the case with Volume II (Cr I and Cr II). Many helpful suggestions from the standpoint of theory have been made by R. E. Trees. K. Kessler with the assistance of the computational laboratory has carried out work on several spectra with the digital computer. Much of the observing on the above programs has been done by C. H. Corliss and W. R. Bozman. All members of the Spectroscopy Section have been most willing collaborators.

At Princeton, A. G. Shenstone has arranged his entire research program to supply data for this Volume. Except for his splendid work, a number of spectra would have been seriously incomplete. The late H. N. Russell also continued to take a keen interest in the work until the time of his death.

At the Oak Ridge National Laboratory, J. R. McNally, Jr., P. M. Griffin, and others have cooperated, as have also M. Fred and F. S. Tomkins at Argonne National Laboratory.

J. E. Mack and his staff, and D. D. Laun in Wisconsin, C. J. Humphreys in Corona, Calif., and R. A Fisher at Northwestern University have been cordial collaborators.

The response from abroad has also been gratifying. In Madrid, the late M. A. Catalán and his entire staff spared no effort in furnishing analyses especially for inclusion here. In Amsterdam, P. F. A. Klinkenberg and J. C. van den Bosch and their students have been very cooperative. G. Racah, in Jerusalem, has been a valuable consultant. R. F. Barrow and H. C. Rowlinson in England; B. Edlén in Sweden; and a group from Canada, A. M. Crooker, R. Nodwell, J. N. P. Hume, and M. F. Crawford have all provided unpublished data.

The writer is deeply indebted to these many contributors, but the users of this Volume, who will have the lasting benefit of this collaboration, are perhaps more deeply indebted. It is sincerely hoped that equally generous support will continue throughout the preparation of Volume IV, which will include the most difficult of all atomic spectra, namely those of the rare-earths.

The services of many experts are required to publish these data. Miss Sarah A. Jones, the Librarian of the Bureau, and her staff, have handled most efficiently the numerous requests for literature references. The splendid work of J. L. Mathusa and the staff in the Publications Section of the Bureau, on the details of publishing these complex tables, has attracted the attention of many users. J. E. Carpenter has been a most helpful consultant. Special thanks are due also to Mrs. Betty L. Arnold whose competence in handling the publication details has been invaluable. The personnel in the Government Printing Office have also been most cooperative. Mrs. Isabel D. Murray has provided competent technical assistance throughout the work.

The writer takes great pleasure in recording here her appreciation of all the generous assistance she has received. The most lasting pleasure comes from the willingness of so many to contribute unselfishly to these Volumes.

Tables

Predicted Terms: Mo I to La I

Hf I to Ac I

References to Rare-Earth Spectra

Ionization Potentials

Chemical Symbols

The Periodic System

Index—Isoelectronic Sequences

TABLE 1. PREDICTED TERMS OF THE Mo I ISOELECTRONIC SEQUENCE

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6+$	Predicted Terms			
$4d^4\ 5s^2$	^{5}D ^{3}P ^{3}D ^{3}F ^{3}G ^{3}H ^{3}P ^{3}F ^{1}S ^{1}D ^{1}F ^{1}G ^{1}I ^{1}S ^{1}D ^{1}G			
$4d^6$	^{5}D ^{3}P ^{3}D ^{3}F ^{3}G ^{3}H ^{3}P ^{3}F ^{1}S ^{1}D ^{1}F ^{1}G ^{1}I ^{1}S ^{1}D ^{1}G			
	ns ($n \geq 5$)	np ($n \geq 5$)	nd ($n \geq 5$)	------
$4d^5(^6S)nx$	^{7}S ^{5}S	^{7}P° ^{5}P°	^{7}D ^{5}D	------ ------
$4d^4\ 5s(^6D)nx$	^{7}D ^{5}D	^{7}P° ^{7}D° ^{7}F° ^{5}P° ^{5}D° ^{5}F°	^{7}S ^{7}P ^{7}D ^{7}F ^{7}G ^{5}S ^{5}P ^{5}D ^{5}F ^{5}G	------ ------
$4d^5(^4G)nx$	^{5}G ^{3}G	^{5}F° ^{5}G° ^{5}H° ^{3}F° ^{3}G° ^{3}H°	^{5}D ^{5}F ^{5}G ^{5}H ^{5}I ^{3}D ^{3}F ^{3}G ^{3}H ^{3}I	------ ------
$4d^5(^4P)nx$	^{5}P ^{3}P	^{5}S° ^{5}P° ^{5}D° ^{3}S° ^{3}P° ^{3}D°	^{5}P ^{5}D ^{5}F ^{3}P ^{3}D ^{3}F	------ ------
$4d^5(^4D)nx$	^{5}D ^{3}D	^{5}P° ^{5}D° ^{5}F° ^{3}P° ^{3}D° ^{3}F°	^{5}S ^{5}P ^{5}D ^{5}F ^{5}G ^{3}S ^{3}P ^{3}D ^{3}F ^{3}G	------ ------
$4d^5(^2D)nx$	^{3}D ^{1}D	^{3}P° ^{3}D° ^{3}F° ^{1}P° ^{1}D° ^{1}F°	^{3}S ^{3}P ^{3}D ^{3}F ^{3}G ^{1}S ^{1}P ^{1}D ^{1}F ^{1}G	------ ------
$4d^5(^2I)nx$	^{3}I ^{1}I	^{3}H° ^{3}I° ^{3}K° ^{1}H° ^{1}I° ^{1}K°	^{3}G ^{3}H ^{3}I ^{3}K ^{3}L ^{1}G ^{1}H ^{1}I ^{1}K ^{1}L	------ ------
$4d^5(^4F)nx$	^{5}F ^{3}F	^{5}D° ^{5}F° ^{5}G° ^{3}D° ^{3}F° ^{3}G°	^{5}P ^{5}D ^{5}F ^{5}G ^{5}H ^{3}P ^{3}D ^{3}F ^{3}G ^{3}H	------ ------
$4d^4\ 5s(^4D)nx$	^{5}D ^{3}D	^{5}P° ^{5}D° ^{5}F° ^{3}P° ^{3}D° ^{3}F°	^{5}S ^{5}P ^{5}D ^{5}F ^{5}G ^{3}S ^{3}P ^{3}D ^{3}F ^{3}G	------ ------
$4d^5(^2F)nx$	^{3}F ^{1}F	^{3}D° ^{3}F° ^{3}G° ^{1}D° ^{1}F° ^{1}G°	^{3}P ^{3}D ^{3}F ^{3}G ^{3}H ^{1}P ^{1}D ^{1}F ^{1}G ^{1}H	------ ------
$4d^4\ 5s(^4H)nx$	^{5}H ^{3}H	^{5}G° ^{5}H° ^{5}I° ^{3}G° ^{3}H° ^{3}I°	^{5}F ^{5}G ^{5}H ^{5}I ^{5}K ^{3}F ^{3}G ^{3}H ^{3}I ^{3}K	------ ------
$4d^5(^2G)nx$	^{3}G ^{1}G	^{3}F° ^{3}G° ^{3}H° ^{1}F° ^{1}G° ^{1}H°	^{3}D ^{3}F ^{3}G ^{3}H ^{3}I ^{1}D ^{1}F ^{1}G ^{1}H ^{1}I	------ ------
$4d^4\ 5s(^4P)nx$	^{5}P ^{3}P	^{5}S° ^{5}P° ^{5}D° ^{3}S° ^{3}P° ^{3}D°	^{5}P ^{5}D ^{5}F ^{3}P ^{3}D ^{3}F	------ ------
$4d^5(^2F)nx$	^{3}F ^{1}F	^{3}D° ^{3}F° ^{3}G° ^{1}D° ^{1}F° ^{1}G°	^{3}P ^{3}D ^{3}F ^{3}G ^{3}H ^{1}P ^{1}D ^{1}F ^{1}G ^{1}H	------ ------
$4d^5(^2H)nx$	^{3}H ^{1}H	^{3}G° ^{3}H° ^{3}I° ^{1}G° ^{1}H° ^{1}I°	^{3}F ^{3}G ^{3}H ^{3}I ^{3}K ^{1}F ^{1}G ^{1}H ^{1}I ^{1}K	------ ------
$4d^4\ 5s(^4F)nx$	^{5}F ^{3}F	^{5}D° ^{5}F° ^{5}G° ^{3}D° ^{3}F° ^{3}G°	^{5}P ^{5}D ^{5}F ^{5}G ^{5}H ^{3}P ^{3}D ^{3}F ^{3}G ^{3}H	------ ------
$4d^5(^2S)nx$	^{3}S ^{1}S	^{3}P° ^{1}F°	^{3}D ^{1}D	------ ------
$4d^4\ 5s(^4G)nx$	^{5}G ^{3}G	^{5}F° ^{5}G° ^{5}H° ^{3}F° ^{3}G° ^{3}H°	^{5}D ^{5}F ^{5}G ^{5}H ^{5}I ^{3}D ^{3}F ^{3}G ^{3}H ^{3}I	------ ------
$4d^4\ 5s(^2P)nx$	^{3}P ^{1}P	^{3}S° ^{3}P° ^{3}D° ^{1}S° ^{1}P° ^{1}D°	^{3}P ^{3}D ^{3}F ^{1}P ^{1}D ^{1}F	------ ------
$4d^5(^2D)nx$	^{3}D ^{1}D	^{3}P° ^{3}D° ^{3}F° ^{1}P° ^{1}D° ^{1}F°	^{3}S ^{3}P ^{3}D ^{3}F ^{3}G ^{1}S ^{1}P ^{1}D ^{1}F ^{1}G	------ ------
$4d^4\ 5s(^2H)nx$	^{3}H ^{1}H	^{3}G° ^{3}H° ^{3}I° ^{1}G° ^{1}H° ^{1}I°	^{3}F ^{3}G ^{3}H ^{3}I ^{3}K ^{1}F ^{1}G ^{1}H ^{1}I ^{1}K	------ ------
$4d^4\ 5s(^4D)nx$	^{5}D ^{3}D	^{5}P° ^{5}D° ^{5}F° ^{3}P° ^{3}D° ^{3}F°	^{5}S ^{5}P ^{5}D ^{5}F ^{5}G ^{3}S ^{3}P ^{3}D ^{3}F ^{3}G	------ ------

Table 2. Predicted Terms of the Tc I Isoelectronic Sequence

Configuration $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6+$	Predicted Terms
$4d^5\,5s^2$	^6S ^4P ^4D ^4F ^4G ^2S ^2D ^2F ^2G ^2I ^2P ^2D ^2F ^2G ^2H ^2D
$4d^7$	^4P ^4F ^2P ^2D ^2F ^2G ^2H ^2D

Configuration	$ns\ (n\geq5)$	$np\ (n\geq5)$	$nd\ (n\geq5)$
$4d^5\,5s(^7S)nx$	^8S ^6S	$^8P^\circ$ $^6P^\circ$	^8D ^6D
$4d^6(^5D)nx$	^6D ^4D	$^6P^\circ$ $^6D^\circ$ $^6F^\circ$ $^4P^\circ$ $^4D^\circ$ $^4F^\circ$	^6S ^6P ^6D ^6F ^6G ^4S ^4P ^4D ^4F ^4G
$4d^5\,5s(^5S)nx$	^6S ^4S	$^6P^\circ$ $^4P^\circ$	^6D ^4D
$4d^6(^3P)nx$	^4P ^2P	$^4S^\circ$ $^4P^\circ$ $^4D^\circ$ $^2S^\circ$ $^2P^\circ$ $^2D^\circ$	^4P ^4D ^4F ^2P ^2D ^2F
$4d^6(^3F)nx$	^4F ^2F	$^4D^\circ$ $^4F^\circ$ $^4G^\circ$ $^2D^\circ$ $^2F^\circ$ $^2G^\circ$	^4P ^4D ^4F ^4G ^4H ^2P ^2D ^2F ^2G ^2H
$4d^6(^3H)nx$	^4H ^2H	$^4G^\circ$ $^4H^\circ$ $^4I^\circ$ $^2G^\circ$ $^2H^\circ$ $^2I^\circ$	^4F ^4G ^4H ^4I ^4K ^2F ^2G ^2H ^2I ^2K
$4d^6(^3G)nx$	^4G ^2G	$^4F^\circ$ $^4G^\circ$ $^4H^\circ$ $^2F^\circ$ $^2G^\circ$ $^2H^\circ$	^4D ^4F ^4G ^4H ^4I ^2D ^2F ^2G ^2H ^2I
$4d^5\,5s(^5G)nx$	^6G ^4G	$^6F^\circ$ $^6G^\circ$ $^6H^\circ$ $^4F^\circ$ $^4G^\circ$ $^4H^\circ$	^6D ^6F ^6G ^6H ^6I ^4D ^4F ^4G ^4H ^4I
$4d^6(^3D)nx$	^4D ^2D	$^4P^\circ$ $^4D^\circ$ $^4F^\circ$ $^2P^\circ$ $^2D^\circ$ $^2F^\circ$	^4S ^4P ^4D ^4F ^4G ^2S ^2P ^2D ^2F ^2G

Configuration	$nf\ (n\geq4)$	$ng\ (n\geq5)$	--------
$4d^5\,5s(^7S)nx$	$^8F^\circ$ $^6F^\circ$	^8G ^6G	-------- --------
$4d^6(^5D)nx$	$^6P^\circ$ $^6D^\circ$ $^6F^\circ$ $^6G^\circ$ $^6H^\circ$ $^4P^\circ$ $^4D^\circ$ $^4F^\circ$ $^4G^\circ$ $^4H^\circ$	^6D ^6F ^6G ^6H ^6I ^4D ^4F ^4G ^4H ^4I	-------- --------
$4d^5\,5s(^5S)nx$	$^6F^\circ$ $^4F^\circ$	^6G ^4G	-------- --------

Table 3: Predicted Terms of the Ru I Isoelectronic Sequence

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6 +$	Predicted Terms			
$4d^8$	^3P ^3F ^1S ^1D ^1G			
$4d^6\,5s^2$	^5D ^3P ^3D ^3F ^3G ^3H ^3P ^3F ^1S ^1D ^1F ^1G ^1I ^1S ^1D ^1G			
	ns $(n \geq 5)$	np $(n \geq 5)$	nd $(n \geq 5)$	......
$4d^7(^4F)nx$	^5F ^3F	$^5D^\circ$ $^5F^\circ$ $^5G^\circ$ $^3D^\circ$ $^3F^\circ$ $^3G^\circ$	^5P ^5D ^5F ^5G ^5H ^3P ^3D ^3F ^3G ^3H	....
$4d^7(^4P)nx$	^5P ^3P	$^5S^\circ$ $^5P^\circ$ $^5D^\circ$ $^3S^\circ$ $^3P^\circ$ $^3D^\circ$	^5P ^5D ^5F ^3P ^3D ^3F	....
$4d^6\,5s(^6D)nx$	^7D ^5D	$^7P^\circ$ $^7D^\circ$ $^7F^\circ$ $^5P^\circ$ $^5D^\circ$ $^5F^\circ$	^7S ^7P ^7D ^7F ^7G ^5S ^5P ^5D ^5F ^5G	....
$4d^7(^2G)nx$	^3G ^1G	$^3F^\circ$ $^3G^\circ$ $^3H^\circ$ $^1F^\circ$ $^1G^\circ$ $^1H^\circ$	^3D ^3F ^3G ^3H ^3I ^1D ^1F ^1G ^1H ^1I	....
$4d^7(^2P)n$	^3P ^1P	$^3S^\circ$ $^3P^\circ$ $^3D^\circ$ $^1S^\circ$ $^1P^\circ$ $^1D^\circ$	^3P ^3D ^3F ^1P ^1D ^1F	....
$4d^7(^2D)nx$	^3D ^1D	$^3P^\circ$ $^3D^\circ$ $^3F^\circ$ $^1P^\circ$ $^1D^\circ$ $^1F^\circ$	^3S ^3P ^3D ^3F ^3G ^1S ^1P ^1D ^1F ^1G	....
$4d^7(^2H)nx$	^3H ^1H	$^3G^\circ$ $^3H^\circ$ $^3I^\circ$ $^1G^\circ$ $^1H^\circ$ $^1I^\circ$	^3F ^3G ^3H ^3I ^3K ^1F ^1G ^1H ^1I ^1K	....
$4d^6\,5s(^4D)nx$	^5D ^3D	$^5P^\circ$ $^5D^\circ$ $^5F^\circ$ $^3P^\circ$ $^3D^\circ$ $^3F^\circ$	^5S ^5P ^5D ^5F ^5G ^3S ^3P ^3D ^3F ^3G	....
$4d^7(^2F)nx$	^3F ^1F	$^3D^\circ$ $^3F^\circ$ $^3G^\circ$ $^1D^\circ$ $^1F^\circ$ $^1G^\circ$	^3P ^3D ^3F ^3G ^3H ^1P ^1D ^1F ^1G ^1H	....
$4d^6\,5s(^4H)nx$	^5H ^3H	$^5G^\circ$ $^5H^\circ$ $^5I^\circ$ $^3G^\circ$ $^3H^\circ$ $^3I^\circ$	^5F ^5G ^5H ^5I ^5K ^3F ^3G ^3H ^3I ^3K	....
$4d^6\,5s(^4P)nx$	^5P ^3P	$^5S^\circ$ $^5P^\circ$ $^5D^\circ$ $^3S^\circ$ $^3P^\circ$ $^3D^\circ$	^5P ^5D ^5F ^3P ^3D ^3F	....
$4d^6\,5s(^4F)nx$	^5F ^3F	$^5D^\circ$ $^5F^\circ$ $^5G^\circ$ $^3D^\circ$ $^3F^\circ$ $^3G^\circ$	^5P ^5D ^5F ^5G ^5H ^3P ^3D ^3F ^3G ^3H	....
$4d^6\,5s(^4G)nx$	^5G ^3G	$^5F^\circ$ $^5G^\circ$ $^5H^\circ$ $^3F^\circ$ $^3G^\circ$ $^3H^\circ$	^5D ^5F ^5G ^5H ^5I ^3D ^3F ^3G ^3H ^3I	....
$4d^6\,5s(^2H)nx$	^3H ^1H	$^3G^\circ$ $^3H^\circ$ $^3I^\circ$ $^1G^\circ$ $^1H^\circ$ $^1I^\circ$	^3F ^3G ^3H ^3I ^3K ^1F ^1G ^1H ^1I ^1K	....

Table 4. Predicted Terms of the Rh I Isoelectronic Sequence

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6+$	Predicted Terms			
$4d^9$	^2D			
$4d^7\,5s^2$	^4P ^4F ^2P ^2D ^2F ^2G ^2H ^2D			
	ns $(n \geq 5)$	np $(n \geq 5)$	nd $(n \geq 5)$	--------
$4d^8(^3F)ns$	^4F ^2F	$^4D^\circ$ $^4F^\circ$ $^4G^\circ$ $^2D^\circ$ $^2F^\circ$ $^2G^\circ$	^4P ^4D ^4F ^4G ^4H ^2P ^2D ^2F ^2G ^2H	-------- --------
$4d^8(^3P)ns$	^4P ^2P	$^4S^\circ$ $^4P^\circ$ $^4D^\circ$ $^2S^\circ$ $^2P^\circ$ $^2D^\circ$	^4P ^4D ^4F ^2P ^2D ^2F	-------- --------
$4d^8(^1G)ns$	^2G	$^2F^\circ$ $^2G^\circ$ $^2H^\circ$	^2D ^2F ^2G ^2H ^2I	--------
$4d^8(^1D)ns$	^2D	$^2P^\circ$ $^2D^\circ$ $^2F^\circ$	^2S ^2P ^2D ^2F ^2G	--------
$4d^8(^1S)ns$	^2S	$^2P^\circ$	^2D	--------
$4d^7\,5s(^5F)ns$	^6F ^4F	$^6D^\circ$ $^6F^\circ$ $^6G^\circ$ $^4D^\circ$ $^4F^\circ$ $^4G^\circ$	^6P ^6D ^6F ^6G ^6H ^4P ^4D ^4F ^4G ^4H	-------- --------
$4d^7\,5s(^5P)ns$	^6P ^4P	$^6S^\circ$ $^6P^\circ$ $^6D^\circ$ $^4S^\circ$ $^4P^\circ$ $^4D^\circ$	^6P ^6D ^6F ^4P ^4D ^4F	-------- --------

TABLE 5. PREDICTED TERMS OF THE Pd I ISOELECTRONIC SEQUENCE

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6+$	Predicted Terms		
$4d^{10}$	^1S		
$4d^8\ 5s^2$	^3P ^3F ^1S ^1D ^1G		
	$ns\ (n \geq 5)$	$np\ (n \geq 5)$	
$4d^9(^2D)nx$	^3D ^1D	$^3P^\circ$ $^3D^\circ$ $^3F^\circ$ $^1P^\circ$ $^1D^\circ$ $^1F^\circ$	
$4d^8\ 5s(^4F)nx'$	^5F ^3F	$^5D^\circ$ $^5F^\circ$ $^5G^\circ$ $^3D^\circ$ $^3F^\circ$ $^3G^\circ$	
$4d^8\ 5s(^2F)nx''$	^3F ^1F	$^3D^\circ$ $^3F^\circ$ $^3G^\circ$ $^1D^\circ$ $^1F^\circ$ $^1G^\circ$	
	$nd\ (n \geq 5)$	$nf\ (n \geq 4)$	---------
$4d^9(^2D)nx$	^3S ^3P ^3D ^3F ^3G ^1S ^1P ^1D ^1F ^1G	$^3P^\circ$ $^3D^\circ$ $^3F^\circ$ $^3G^\circ$ $^3H^\circ$ $^1P^\circ$ $^1D^\circ$ $^1F^\circ$ $^1G^\circ$ $^1H^\circ$	--------- ------
$4d^8\ 5s(^4F)nx'$	^5P ^5D ^5F ^5G ^5H ^3P ^3D ^3F ^3G ^3H	$^5S^\circ$ $^5P^\circ$ $^5D^\circ$ $^5F^\circ$ $^5G^\circ$ $^5H^\circ$ $^5I^\circ$ $^3S^\circ$ $^3P^\circ$ $^3D^\circ$ $^3F^\circ$ $^3G^\circ$ $^3H^\circ$ $^3I^\circ$	----- -----
$4d^8\ 5s(^2F)nx''$	^3P ^3D ^3F ^3G ^3H ^1P ^1D ^1F ^1G ^1H	$^3S^\circ$ $^3P^\circ$ $^3D^\circ$ $^3F^\circ$ $^3G^\circ$ $^3H^\circ$ $^3I^\circ$ $^1S^\circ$ $^1P^\circ$ $^1D^\circ$ $^1F^\circ$ $^1G^\circ$ $^1H^\circ$ $^1I^\circ$	------- ----------

TABLE 6. PREDICTED TERMS OF THE Ag I ISOELECTRONIC SEQUENCE

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2$ $3p^6\ 3d^{10}\ 4s^2\ 4p^6+$	Predicted Terms		
$4d^9\ 5s^2$	^2D		
	$ns\ (n \geq 5)$	$np\ (n \geq 5)$	$nd\ (n \geq 5)$
$4d^{10}(^1S)nx$	^2S	$^2P^\circ$	^2D
$4d^9\ 5s(^3D)nx'$	^4D ^2D	$^4P^\circ$ $^4D^\circ$ $^4F^\circ$ $^2P^\circ$ $^2D^\circ$ $^2F^\circ$	^4S ^4P ^4D ^4F ^4G ^2S ^2P ^2D ^2F ^2G
$4d^9\ 5s(^1D)nx''$	^2D	$^2P^\circ$ $^2D^\circ$ $^2F^\circ$	^2S ^2P ^2D ^2F ^2G
	$nf\ (n \geq 4)$	$ng\ (n \geq 5)$	------------
$4d^{10}(^1S)nx$	$^2F^\circ$	^2G	------------
$4d^9\ 5s(^3D)nx'$	$^4P^\circ$ $^4D^\circ$ $^4F^\circ$ $^4G^\circ$ $^4H^\circ$ $^2P^\circ$ $^2D^\circ$ $^2F^\circ$ $^2G^\circ$ $^2H^\circ$	^4D ^4F ^4G ^4H ^4I ^2D ^2F ^2G ^2H ^2I	------------ ------------
$4d^9\ 5s(^1D)nx''$	$^2P^\circ$ $^2D^\circ$ $^2F^\circ$ $^2G^\circ$ $^2H^\circ$	^2D ^2F ^2G ^2H ^2I	------------

TABLE 7. PREDICTED TERMS OF THE Cd I ISOELECTRONIC SEQUENCE

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6+$	Predicted Terms		
$4d^{10}\,5s^2$	^1S		
$4d^{10}\,5p^2$	^3P ^1S ^1D		
$4d^{10}\,5d^2$	^3P ^3F ^1S ^1D ^1G		
	$ns\ (n \geq 5)$	$np\ (n \geq 5)$	$nd\ (n \geq 5)$
$4d^{10}\,5s(^2S)ns$	^3S ^1S	$^3P^o$ $^1P^o$	^3D ^1D
$4d^{10}\,5p(^2P^o)ns'$	$^3P^o$ $^1P^o$	^3S ^3P ^3D ^1S ^1P ^1D	$^3P^o$ $^3D^o$ $^3F^o$ $^1P^o$ $^1D^o$ $^1F^o$
$4d^{10}\,5d(^2D)ns''$	^3D ^1D	$^3P^o$ $^3D^o$ $^3F^o$ $^1P^o$ $^1D^o$ $^1F^o$	^3S ^3P ^3D ^3F ^3G ^1S ^1P ^1D ^1F ^1G
	$nf\ (n \geq 4)$	$ng\ (n \geq 5)$	------------
$4d^{10}\,5s(^2S)ns$	$^3F^o$ $^1F^o$	^3G ^1G	------------ ------------
$4d^{10}\,5p(^2P^o)ns'$	^3D ^3F ^3G ^1D ^1F ^1G	$^3F^o$ $^3G^o$ $^3H^o$ $^1F^o$ $^1G^o$ $^1H^o$	------------ ------------
$4d^{10}\,5d(^2D)ns''$	$^3P^o$ $^3D^o$ $^3F^o$ $^3G^o$ $^3H^o$ $^1P^o$ $^1D^o$ $^1F^o$ $^1G^o$ $^1H^o$	^3D ^3F ^3G ^3H ^3I ^1D ^1F ^1G ^1H ^1I	------------ ------------

TABLE 8. PREDICTED TERMS OF THE In I ISOELECTRONIC SEQUENCE

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}+$	Predicted Terms					
$5s^2(^1S)5p$	$^2P^o$					
$5s\,5p^2$	^4P ^2S ^2P ^2D					
$5p^3$	$^4S^o$ $^2P^o$ $^2D^o$					
	$ns\ (n \geq 6)$	$np\ (n \geq 6)$	$nd\ (n \geq 5)$	$nf\ (n \geq 4)$	$ng\ (n \geq 5)$	---------
$5s^2(^1S)ns$	^2S	$^2P^o$	^2D	$^2F^o$	^2G	---------
$5s\,5p(^3P^o)ns'$	$^4P^o$ $^2P^o$	^4S ^4P ^4D ^2S ^2P ^2D	$^4P^o$ $^4D^o$ $^4F^o$ $^2P^o$ $^2D^o$ $^2F^o$	^4D ^4F ^4G ^2D ^2F ^2G	$^4F^o$ $^4G^o$ $^4H^o$ $^2F^o$ $^2G^o$ $^2H^o$	--------- ---------
$5s\,5p(^1P^o)ns''$	$^2P^o$	^2S ^2P ^2D	$^2P^o$ $^2D^o$ $^2F^o$	^2D ^2F ^2G	$^2F^o$ $^2G^o$ $^2H^o$	---------

Table 9. Predicted Terms of the Sn I Isoelectronic Sequence

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}+$	Predicted Terms				
$5s^2\ 5p^2$	^1S ^3P ^1D				
$5s\ 5p^3$	$^5S^\circ$ $^3S^\circ$ $^3P^\circ$ $^1P^\circ$ $^3D^\circ$ $^1D^\circ$				
	$ns\ (n \geq 6)$	$np\ (n \geq 6)$	$nd\ (n \geq 5)$	$nf\ (n \geq 4)$	---------
$5s^2\ 5p(^2P^\circ)nx$	$^3P^\circ$ $^1P^\circ$	^3S ^1S ^3P ^1P ^3D ^1D	$^3P^\circ$ $^1P^\circ$ $^3D^\circ$ $^1D^\circ$ $^3F^\circ$ $^1F^\circ$	^3D ^1D ^3F ^1F ^3G ^1G	--------- ---------
$5s\ 5p^2(^4P)nx'$	^5P ^3P	$^5S^\circ$ $^3S^\circ$ $^5P^\circ$ $^3P^\circ$ $^5D^\circ$ $^3D^\circ$	^5P ^3P ^5D ^3D ^5F ^3F	$^5D^\circ$ $^3D^\circ$ $^5F^\circ$ $^3F^\circ$ $^5G^\circ$ $^3G^\circ$	--------- ---------

Table 10. Predicted Terms of the Sb I Isoelectronic Sequence

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}+$	Predicted Terms				
$5s^2\ 5p^3$	$^4S^\circ$ $^2P^\circ$ $^2D^\circ$				
$5s\ 5p^4$	^2S ^4P ^2P ^2D				
$5p^5$	$^2P^\circ$				
	$ns\ (n \geq 6)$	$np\ (n \geq 6)$	$nd\ (n \geq 5)$	$nf\ (n \geq 4)$	---------
$5s^2\ 5p^2(^3P)nx$	^4P ^2P	$^4S^\circ$ $^2S^\circ$ $^4P^\circ$ $^2P^\circ$ $^4D^\circ$ $^2D^\circ$	^4P ^2P ^4D ^2D ^4F ^2F	$^4D^\circ$ $^2D^\circ$ $^4F^\circ$ $^2F^\circ$ $^4G^\circ$ $^2G^\circ$	--------- ---------
$5s^2\ 5p^2(^1D)nx'$	^2D	$^2P^\circ$ $^2D^\circ$ $^2F^\circ$	^2S ^2P ^2D ^2F ^2G	$^2P^\circ$ $^2D^\circ$ $^2F^\circ$ $^2G^\circ$ $^2H^\circ$	---------
$5s^2\ 5p^2(^1S)nx''$	^2S	$^2P^\circ$	^2D	$^2F^\circ$	---------

TABLE 11. PREDICTED TERMS OF THE Te I ISOELECTRONIC SEQUENCE

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}+$	Predicted Terms				
$5s^2\,5p^4$	^1S ^3P ^1D				
$5s\,5p^5$	$^3P^\circ$ $^1P^\circ$				
	$ns\ (n\geq 6)$	$np\ (n\geq 6)$	$nd\ (n\geq 5)$	$nf\ (n\geq 4)$	--------
$5s^2\,5p^3(^4S^\circ)nx$	$^5S^\circ$ $^3S^\circ$	^5P ^3P	$^5D^\circ$ $^3D^\circ$	^5F ^3F	-------- --------
$5s^2\,5p^3(^2D^\circ)nx'$	$^3D^\circ$ $^1D^\circ$	^3P ^3D ^3F ^1P ^1D ^1F	$^3S^\circ$ $^3P^\circ$ $^3D^\circ$ $^3F^\circ$ $^3G^\circ$ $^1S^\circ$ $^1P^\circ$ $^1D^\circ$ $^1F^\circ$ $^1G^\circ$	^3P ^3D ^3F ^3G ^3H ^1P ^1D ^1F ^1G ^1H	-------- --------
$5s^2\,5p^3(^2P^\circ)nx''$	$^3P^\circ$ $^1P^\circ$	^3S ^3P ^3D ^1S ^1P ^1D	$^3P^\circ$ $^3D^\circ$ $^3F^\circ$ $^1P^\circ$ $^1D^\circ$ $^1F^\circ$	^3D ^3F ^3G ^1D ^1F ^1G	-------- --------

TABLE 12. PREDICTED TERMS OF THE I I ISOELECTRONIC SEQUENCE

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}+$	Predicted Terms					
$5s^2\,5p^5$	$^2P^\circ$					
$5s\,5p^6$	^2S					
	$ns\ (n\geq 6)$	$np\ (n\geq 6)$	$nd\ (n\geq 5)$	$nf\ (n\geq 4)$	$ng\ (n\geq 5)$	------
$5s^2\,5p^4(^3P)nx$	^4P ^2P	$^4S^\circ$ $^4P^\circ$ $^4D^\circ$ $^2S^\circ$ $^2P^\circ$ $^2D^\circ$	^4P ^4D ^4F ^2P ^2D ^2F	$^4D^\circ$ $^4F^\circ$ $^4G^\circ$ $^2D^\circ$ $^2F^\circ$ $^2G^\circ$	^4F ^4G ^4H ^2F ^2G ^2H	------ ------
$5s^2\,5p^4(^1D)nx'$	^2D	$^2P^\circ$ $^2D^\circ$ $^2F^\circ$	^2S ^2P ^2D ^2F ^2G	$^2P^\circ$ $^2D^\circ$ $^2F^\circ$ $^2G^\circ$ $^2H^\circ$	^2D ^2F ^2G ^2H ^2I	------
$5s^2\,5p^4(^1S)nx''$	^2S	$^2P^\circ$	^2D	$^2F^\circ$	^2G	------
$5s\,5p^6(^3P^\circ)nx'''$	$^4P^\circ$ $^2P^\circ$	^4S ^4P ^4D ^2S ^2P ^2D	$^4P^\circ$ $^4D^\circ$ $^4F^\circ$ $^2P^\circ$ $^2D^\circ$ $^2F^\circ$	^4D ^4F ^4G ^2D ^2F ^2G	$^4F^\circ$ $^4G^\circ$ $^4H^\circ$ $^2F^\circ$ $^2G^\circ$ $^2H^\circ$	------ ------

Table 13. Predicted Levels of the Xe I Isoelectronic Sequence

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}+$	Predicted Terms				
$5s^2\ 5p^6$	^1S				
	$ns\ (n\geq 6)$	$np\ (n\geq 6)$	$nd\ (n\geq 5)$	$nf\ (n\geq 4)$	....
$5s^2\ 5p^5(^2P^\circ)nx$	$^3P^\circ$ $^1P^\circ$	$^3S\ \ ^3P\ \ ^3D$ $^1S\ \ ^1P\ \ ^1D$	$^3P^\circ\ \ ^3D^\circ\ \ ^3F^\circ$ $^1P^\circ\ \ ^1D^\circ\ \ ^1F^\circ$	$^3D\ \ ^3F\ \ ^3G$ $^1D\ \ ^1F\ \ ^1G$	....
$5s\ 5p^6(^2S)nx'$	^3S ^1S	$^3P^\circ$ $^1P^\circ$	^3D ^1D	$^3F^\circ$ $^1F^\circ$	....

Jl-Coupling Notation

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}+$	Predicted Pairs				
	$ns\ (n\geq 6)$	$np\ (n\geq 6)$	$nd\ (n\geq 5)$	$nf\ (n\geq 4)$	....
$5s^2\ 5p^5(^2P^\circ_{1½})nx$	[1½]°	[0½] [2½] [1½]	[0½]° [3½]° [1½]° [2½]°	[1½] [4½] [2½] [3½]	....
$5s^2\ 5p^5(^2P^\circ_{0½})nx'$	[0½]°	[1½] [0½]	[2½]° [1½]°	[3½] [2½]	....

Table 14. Predicted Terms of the Ba I Isoelectronic Sequence

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 5s^2\ 5p^6+$	Predicted Terms		
$6s^2$	^1S		
$5d^2$	$^3P\ \ ^3F$ $^1S\ \ ^1D\ \ ^1G$		
$6p^2$	^3P $^1S\ \ ^1D$		
$4f^2$	$^3P\ \ ^3F\ \ ^3H$ $^1S\ \ ^1L\ \ ^1G\ \ ^1I$		
	$ns\ (n\geq 6)$	$np\ (n\geq 6)$	$nd\ (n\geq 5)$
$6s(^2S)nx$	^3S ^1S	$^3P^\circ$ $^1P^\circ$	^3D ^1D
$5d(^2D)nx'$	^3D ^1D	$^3P^\circ\ \ ^3D^\circ\ \ ^3F^\circ$ $^1P^\circ\ \ ^1D^\circ\ \ ^1F^\circ$	$^3S\ \ ^3P\ \ ^3D\ \ ^3F\ \ ^3G$ $^1S\ \ ^1P\ \ ^1D\ \ ^1F\ \ ^1G$
$6p(^2P^\circ)nx''$	$^3P^\circ$ $^1P^\circ$	$^3S\ \ ^3P\ \ ^3D$ $^1S\ \ ^1P\ \ ^1D$	$^3P^\circ\ \ ^3D^\circ\ \ ^3F^\circ$ $^1P^\circ\ \ ^1D^\circ\ \ ^1F^\circ$
	$nf\ (n\geq 4)$	$ng\ (n\geq 5)$	....
$6s(^2S)nx$	$^3F^\circ$ $^1F^\circ$	^3G ^1G	....
$5d(^2D)nx'$	$^3P^\circ\ \ ^3D^\circ\ \ ^3F^\circ\ \ ^3G^\circ\ \ ^3H^\circ$ $^1P^\circ\ \ ^1D^\circ\ \ ^1F^\circ\ \ ^1G^\circ\ \ ^1H^\circ$	$^3D\ \ ^3F\ \ ^3G\ \ ^3H\ \ ^3I$ $^1D\ \ ^1F\ \ ^1G\ \ ^1H\ \ ^1I$	....
$6p(^2P^\circ)nx''$	$^3D\ \ ^3F\ \ ^3G$ $^1D\ \ ^1F\ \ ^1G$	$^3F^\circ\ \ ^3G^\circ\ \ ^3H^\circ$ $^1F^\circ\ \ ^1G^\circ\ \ ^1H^\circ$	....

Table 15. Predicted Terms of the La I Isoelectronic Sequence

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,5s^2\,5p^6+$	Predicted Terms
$5d\,6s^2$	^{2}D
$5d^3$	^{4}P ^{4}F ^{2}P ^{2}D ^{2}F ^{2}G ^{2}H ^{2}D

Configuration	ns ($n \geq 6$)	np ($n \geq 6$)
$5d^2(^3F)nx$	^{4}F ^{2}F	^{4}D° ^{4}F° ^{4}G° ^{2}D° ^{2}F° ^{2}G°
$5d\,6s(^1D)nx$	^{2}D	^{2}P° ^{2}D° ^{2}F°
$5d\,6s(^3D)nx$	^{4}D ^{2}D	^{4}P° ^{4}D° ^{4}F° ^{2}P° ^{2}D° ^{2}F°
$5d^2(^3P)nx$	^{4}P ^{2}P	^{4}S° ^{4}P° ^{4}D° ^{2}S° ^{2}P° ^{2}D°
$6s^2(^1S)nx$	^{2}S	^{2}P°
$5d^2(^1G)nx$	^{2}G	^{2}F° ^{2}G° ^{2}H°
$5d^2(^1D)nx$	^{2}D	^{2}P° ^{2}D° ^{2}F°

Configuration	nd ($n \geq 5$)	nf ($n \geq 4$)	-------
$5d^2(^3F)nx$	^{4}P ^{4}D ^{4}F ^{4}G ^{4}H ^{2}P ^{2}D ^{2}F ^{2}G ^{2}H	^{4}S° ^{4}P° ^{4}D° ^{4}F° ^{4}G° ^{4}H° ^{4}I° ^{2}S° ^{2}P° ^{2}D° ^{2}F° ^{2}G° ^{2}H° ^{2}I°	------- -------
$5d\,6s(^1D)nx$	^{2}S ^{2}P ^{2}D ^{2}F ^{2}G	^{2}P° ^{2}D° ^{2}F° ^{2}G° ^{2}H°	-------
$5d\,6s(^3D)nx$	^{4}S ^{4}P ^{4}D ^{4}F ^{4}G ^{2}S ^{2}P ^{2}D ^{2}F ^{2}G	^{4}P° ^{4}D° ^{4}F° ^{4}G° ^{4}H° ^{2}P° ^{2}D° ^{2}F° ^{2}G° ^{2}H°	------- -------
$5d^2(^3P)nx$	^{4}P ^{4}D ^{4}F ^{2}P ^{2}D ^{2}F	^{4}D° ^{4}F° ^{4}G° ^{2}D° ^{2}F° ^{2}G°	------- -------
$6s^2(^1S)nx$	^{2}D	^{2}F°	-------
$5d^2(^1G)nx$	^{2}D ^{2}F ^{2}G ^{2}H ^{2}I	^{2}P° ^{2}D° ^{2}F° ^{2}G° ^{2}H° ^{2}I° ^{2}K°	-------
$5d^2(^1D)nx$	^{2}S ^{2}P ^{2}D ^{2}F ^{2}G	^{2}P° ^{2}D° ^{2}F° ^{2}G° ^{2}H°	-------

TABLE 16. PREDICTED TERMS OF THE Hf I ISOELECTRONIC SEQUENCE

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6+$	Predicted Terms			
$5d^2\ 6s^2$	^{3}P ^{3}F ^{1}S ^{1}D ^{1}G			
$5d^4$	^{5}D ^{3}P ^{3}D ^{3}F ^{3}G ^{3}H ^{3}P ^{3}F ^{1}S ^{1}D ^{1}F ^{1}G ^{1}I ^{1}S ^{1}D ^{1}G			
	ns ($n \geq 6$)	np ($n \geq 6$)	nd ($n \geq 6$)	....
$5d^2\ 6s(^4F)nx$	^{5}F ^{3}F	^{5}D° ^{5}F° ^{5}G° ^{3}D° ^{3}F° ^{3}G°	^{5}P ^{5}D ^{5}F ^{5}G ^{5}H ^{3}P ^{3}D ^{3}F ^{3}G ^{3}H	....
$5d^2\ 6s(^4P)nx$	^{5}P ^{3}P	^{5}S° ^{5}P° ^{5}D° ^{3}S° ^{3}P° ^{3}D°	^{5}P ^{5}D ^{5}F ^{3}P ^{3}D ^{3}F	....
$5d^2\ 6s(^2F)nx$	^{3}F ^{1}F	^{3}D° ^{3}F° ^{3}G° ^{1}D° ^{1}F° ^{1}G°	^{3}P ^{3}D ^{3}F ^{3}G ^{3}H ^{1}P ^{1}D ^{1}F ^{1}G ^{1}H	....
$5d^2\ 6s(^2D)nx$	^{3}D ^{1}D	^{3}P° ^{3}D° ^{3}F° ^{1}P° ^{1}D° ^{1}F°	^{3}S ^{3}P ^{3}D ^{3}F ^{3}G ^{1}S ^{1}P ^{1}D ^{1}F ^{1}G	....
$5d^2\ 6s(^2P)nx$	^{3}P ^{1}P	^{3}S° ^{3}P° ^{3}D° ^{1}S° ^{1}P° ^{1}D°	^{3}P ^{3}D ^{3}F ^{1}P ^{1}D ^{1}F	....
$5d^2\ 6s(^2G)nx$	^{3}G ^{1}G	^{3}F° ^{3}G° ^{3}H° ^{1}F° ^{1}G° ^{1}H°	^{3}D ^{3}F ^{3}G ^{3}H ^{3}I ^{1}D ^{1}F ^{1}G ^{1}H ^{1}I	....
$5d^3(^4F)nx$	^{5}F ^{3}F	^{5}D° ^{5}F° ^{5}G° ^{3}D° ^{3}F° ^{3}G°	^{5}P ^{5}D ^{5}F ^{5}G ^{5}H ^{3}P ^{3}D ^{3}F ^{3}G ^{3}H	....
$5d^3(^4P)nx$	^{5}P ^{3}P	^{5}S° ^{5}P° ^{5}D° ^{3}S° ^{3}P° ^{3}D°	^{5}P ^{5}D ^{5}F ^{3}P ^{3}D ^{3}F	....
$5d^3(^2G)nx$	^{3}G ^{1}G	^{3}F° ^{3}G° ^{3}H° ^{1}F° ^{1}G° ^{1}H°	^{3}D ^{3}F ^{3}G ^{3}H ^{3}I ^{1}D ^{1}F ^{1}G ^{1}H ^{1}I	....
$5d^3(^2D)nx$	^{3}D ^{1}D	^{3}P° ^{3}D° ^{3}F° ^{1}P° ^{1}D° ^{1}F°	^{3}S ^{3}P ^{3}D ^{3}F ^{3}G ^{1}S ^{1}P ^{1}D ^{1}F ^{1}G	....
$5d^3(^2H)nx$	^{3}H ^{1}H	^{3}G° ^{3}H° ^{3}I° ^{1}G° ^{1}H° ^{1}I°	^{3}F ^{3}G ^{3}H ^{3}I ^{3}K ^{1}F ^{1}G ^{1}H ^{1}I ^{1}K	....
$5d^3(^2P)nx$	^{3}P ^{1}P	^{3}S° ^{3}P° ^{3}D° ^{1}S° ^{1}P° ^{1}D°	^{3}P ^{3}D ^{3}F ^{1}P ^{1}D ^{1}F	....
$5d^3(^2F)nx$	^{3}F ^{1}F	^{3}D° ^{3}F° ^{3}G° ^{1}D° ^{1}F° ^{1}G°	^{3}P ^{3}D ^{3}F ^{3}G ^{3}H ^{1}P ^{1}D ^{1}F ^{1}G ^{1}H	....

Table 17. Predicted Terms of the Ta I Isoelectronic Sequence

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}$ $4s^2\,4p^6\,4d^{10}\,4f^{14}\,5s^2\,5p^6+$	Predicted Terms			
$5d^3\,6s^2$	^{4}P ^{4}F ^{2}P ^{2}D ^{2}F ^{2}G ^{2}H ^{2}D			
$5d^5$	^{6}S ^{4}P ^{4}D ^{4}F ^{4}G ^{2}S ^{2}D ^{2}F ^{2}G ^{2}I ^{2}P ^{2}D ^{2}F ^{2}G ^{2}H ^{2}D			
	ns $(n \geq 6)$	np $(n \geq 6)$	nd $(n \geq 6)$	--------
$5d^3\,6s(^5F)nx$	^{6}F ^{4}F	^{6}D° ^{6}F° ^{6}G° ^{4}D° ^{4}F° ^{4}G°	^{6}P ^{6}D ^{6}F ^{6}G ^{6}H ^{4}P ^{4}D ^{4}F ^{4}G ^{4}H	-------- --------
$5d^2\,6s^2(^3F)nx$	^{4}F ^{2}F	^{4}D° ^{4}F° ^{4}G° ^{2}D° ^{2}F° ^{2}G°	^{4}P ^{4}D ^{4}F ^{4}G ^{4}H ^{2}P ^{2}D ^{2}F ^{2}G ^{2}H	-------- --------
$5d^2\,6s^2(^3P)nx$	^{4}P ^{2}P	^{4}S° ^{4}P° ^{4}D° ^{2}S° ^{2}P° ^{2}D°	^{4}P ^{4}D ^{4}F ^{2}P ^{2}D ^{2}F	-------- --------
$5d^3\,6s(^3F)nx$	^{4}F ^{2}F	^{4}D° ^{4}F° ^{4}G° ^{2}D° ^{2}F° ^{2}G°	^{4}P ^{4}D ^{4}F ^{4}G ^{4}H ^{2}P ^{2}D ^{2}F ^{2}G ^{2}H	-------- --------
$5d^3\,6s(^5P)nx$	^{6}P ^{4}P	^{6}S° ^{6}P° ^{6}D° ^{4}S° ^{4}P° ^{4}D°	^{6}P ^{6}D ^{6}F ^{4}P ^{4}D ^{4}F	-------- --------
$5d^3\,6s(^3G)nx$	^{4}G ^{2}G	^{4}F° ^{4}G° ^{4}H° ^{2}F° ^{2}G° ^{2}H°	^{4}D ^{4}F ^{4}G ^{4}H ^{4}I ^{2}D ^{2}F ^{2}G ^{2}H ^{2}I	-------- --------
$5d^4(^5D)nx$	^{6}D ^{4}D	^{6}P° ^{6}D° ^{6}F° ^{4}P° ^{4}D° ^{4}F°	^{6}S ^{6}P ^{6}D ^{6}F ^{6}G ^{4}S ^{4}P ^{4}D ^{4}F ^{4}G	-------- --------
$5d^2\,6s^2(^1D)nx$	^{2}D	^{2}P° ^{2}D° ^{2}F°	^{2}S ^{2}P ^{2}D ^{2}F ^{2}G	--------
$5d^3\,6s(^3D)nx$	^{4}D ^{2}D	^{4}P° ^{4}D° ^{4}F° ^{2}P° ^{2}D° ^{2}F°	^{4}S ^{4}P ^{4}D ^{4}F ^{4}G ^{2}S ^{2}P ^{2}D ^{2}F ^{2}G	-------- --------
$5d^3\,6s(^3H)nx$	^{4}H ^{2}H	^{4}G° ^{4}H° ^{4}I° ^{2}G° ^{2}H° ^{2}I°	^{4}F ^{4}G ^{4}H ^{4}I ^{4}K ^{2}F ^{2}G ^{2}H ^{2}I ^{2}K	-------- --------
$5d^3\,6s(^3P)nx$	^{4}P ^{2}P	^{4}S° ^{4}P° ^{4}D° ^{2}S° ^{2}P° ^{2}D°	^{4}P ^{4}D ^{4}F ^{2}P ^{2}D ^{2}F	-------- --------
$5d^3\,6s(^1D)nx$	^{2}D	^{2}P° ^{2}D° ^{2}F°	^{2}S ^{2}P ^{2}D ^{2}F ^{2}G	--------
$5d^3\,6s(^1P)nx$	^{2}P	^{2}S° ^{2}P° ^{2}D°	^{2}P ^{2}D ^{2}F	--------
$5d^4(^3H)nx$	^{4}H ^{2}H	^{4}G° ^{4}H° ^{4}I° ^{2}G° ^{2}H° ^{2}I°	^{4}F ^{4}G ^{4}H ^{4}I ^{4}K ^{2}F ^{2}G ^{2}H ^{2}I ^{2}K	-------- --------
$5d^3\,6s(^1F)nx$	^{2}F	^{2}D° ^{2}F° ^{2}G°	^{2}P ^{2}D ^{2}F ^{2}G ^{2}H	--------
$5d^4(^3G)nx$	^{4}G ^{2}G	^{4}F° ^{4}G° ^{4}H° ^{2}F° ^{2}G° ^{2}H°	^{4}D ^{4}F ^{4}G ^{4}H ^{4}I ^{2}D ^{2}F ^{2}G ^{2}H ^{2}I	-------- --------
$5d^4(^3F)nx$	^{4}F ^{2}F	^{4}D° ^{4}F° ^{4}G° ^{2}D° ^{2}F° ^{2}G°	^{4}P ^{4}D ^{4}F ^{4}G ^{4}H ^{2}P ^{2}D ^{2}F ^{2}G ^{2}H	-------- --------

Table 18. Predicted Terms of the W I Isoelectronic Sequence

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}$ $4s^2\,4p^6\,4d^{10}\,4f^{14}\,5s^2\,5p^6+$	Predicted Terms			
$5d^4\,6s^2$	^5D $^3P\ {}^3D\ {}^3F\ {}^3G\ {}^3H$ $^3P\ {}^3F$ $^1S\ {}^1D\ {}^1F\ {}^1G\ {}^1I$ $^1S\ {}^1D\ {}^1G$			
$5d^6$	^5D $^3P\ {}^3D\ {}^3F\ {}^3G\ {}^3H$ $^3P\ {}^3F$ $^1S\ {}^1D\ {}^1F\ {}^1G\ {}^1I$ $^1S\ {}^1D\ {}^1G$			
	$ns\ (n\geq 6)$	$np\ (n\geq 6)$	$nd\ (n\geq 6)$	......
$5d^4\,6s(a\,^6D)nx$	^7D ^5D	$^7P^\circ\ {}^7D^\circ\ {}^7F^\circ$ $^5P^\circ\ {}^5D^\circ\ {}^5F^\circ$	$^7S\ {}^7P\ {}^7D\ {}^7F\ {}^7G$ $^5S\ {}^5P\ {}^5D\ {}^5F\ {}^5G$	....
$5d^5(^6S)nx$	^7S ^5S	$^7P^\circ$ $^5P^\circ$	^7D ^5D	....
$5d^4\,6s(^4F)nx$	^5F ^3F	$^5D^\circ\ {}^5F^\circ\ {}^5G^\circ$ $^3D^\circ\ {}^3F^\circ\ {}^3G^\circ$	$^5P\ {}^5D\ {}^5F\ {}^5G\ {}^5H$ $^3P\ {}^3D\ {}^3F\ {}^3G\ {}^3H$	....
$5d^4\,6s(^4P)nx$	^5P ^3P	$^5S^\circ\ {}^5P^\circ\ {}^5D^\circ$ $^3S^\circ\ {}^3P^\circ\ {}^3D^\circ$	$^5P\ {}^5D\ {}^5F$ $^3P\ {}^3D\ {}^3F$	....
$5d^4\,6s(^4D)nx$	^5D ^3D	$^5P^\circ\ {}^5D^\circ\ {}^5F^\circ$ $^3P^\circ\ {}^3D^\circ\ {}^3F^\circ$	$^5S\ {}^5P\ {}^5D\ {}^5F\ {}^5G$ $^3S\ {}^3P\ {}^3D\ {}^3F\ {}^3G$	....
$5d^5(^4G)nx$	^5G ^3G	$^5F^\circ\ {}^5G^\circ\ {}^5H^\circ$ $^3F^\circ\ {}^3G^\circ\ {}^3H^\circ$	$^5D\ {}^5F\ {}^5G\ {}^5H\ {}^5I$ $^3D\ {}^3F\ {}^3G\ {}^3H\ {}^3I$	....
$5d^4\,6s(^4G)nx$	^5G ^3G	$^5F^\circ\ {}^5G^\circ\ {}^5H^\circ$ $^3F^\circ\ {}^3G^\circ\ {}^3H^\circ$	$^5D\ {}^5F\ {}^5G\ {}^5H\ {}^5I$ $^3D\ {}^3F\ {}^3G\ {}^3H\ {}^3I$	....
$5d^5(^2D)nx$	^3D ^1D	$^3P^\circ\ {}^3D^\circ\ {}^3F^\circ$ $^1P^\circ\ {}^1D^\circ\ {}^1F^\circ$	$^3S\ {}^3P\ {}^3D\ {}^3F\ {}^3G$ $^1S\ {}^1P\ {}^1D\ {}^1F\ {}^1G$	....
$5d^4\,6s(^2F)nx$	^3F ^1F	$^3D^\circ\ {}^3F^\circ\ {}^3G^\circ$ $^1D^\circ\ {}^1F^\circ\ {}^1G^\circ$	$^3P\ {}^3D\ {}^3F\ {}^3G\ {}^3H$ $^1P\ {}^1D\ {}^1F\ {}^1G\ {}^1H$	....
$5d^4\,6s(^2P)nx$	^3P ^1P	$^3S^\circ\ {}^3P^\circ\ {}^3D^\circ$ $^1S^\circ\ {}^1P^\circ\ {}^1D^\circ$	$^3P\ {}^3D\ {}^3F$ $^1P\ {}^1D\ {}^1F$	....
$5d^4\,6s(^4H)nx$	^5H ^3H	$^5G^\circ\ {}^5H^\circ\ {}^5I^\circ$ $^3G^\circ\ {}^3H^\circ\ {}^3I^\circ$	$^5F\ {}^5G\ {}^5H\ {}^5I\ {}^5K$ $^3F\ {}^3G\ {}^3H\ {}^3I\ {}^3K$	....
$5d^5(^4P)nx$	^5P ^3P	$^5S^\circ\ {}^5P^\circ\ {}^5D^\circ$ $^3S^\circ\ {}^3P^\circ\ {}^3D^\circ$	$^5P\ {}^5D\ {}^5F$ $^3P\ {}^3D\ {}^3F$	....
$5d^5(^4D)nx$	^5D ^3D	$^5P^\circ\ {}^5D^\circ\ {}^5F^\circ$ $^3P^\circ\ {}^3D^\circ\ {}^3F^\circ$	$^5S\ {}^5P\ {}^5D\ {}^5F\ {}^5G$ $^3S\ {}^3P\ {}^3D\ {}^3F\ {}^3G$	....
$5d^5(^4F)nx$	^5F ^3F	$^5D^\circ\ {}^5F^\circ\ {}^5G^\circ$ $^3D^\circ\ {}^3F^\circ\ {}^3G^\circ$	$^5P\ {}^5D\ {}^5F\ {}^5G\ {}^5H$ $^3P\ {}^3D\ {}^3F\ {}^3G\ {}^3H$	....

TABLE 19. PREDICTED TERMS OF THE Re I ISOELECTRONIC SEQUENCE

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}$ $4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6 +$	Predicted Terms			
$5d^5\ 6s^2$	^6S ^4P ^4D ^4F ^4G ^2S ^2D ^2F ^2G ^2I ^2P ^2D ^2F ^2G ^2H ^2D			
$5d^7$	^4P ^4F ^2P ^2D ^2F ^2G ^2H ^2D			
	$ns\ (n \geq 6)$	$np\ (n \geq 6)$	$nd\ (n \geq 6)$	------
$5d^5\ 6s(^7S)nx$	^8S ^6S	$^8P^\circ$ $^6P^\circ$	^8D ^6D	------ ------
$5d^6(^5D)nx$	^6D ^4D	$^6P^\circ$ $^6D^\circ$ $^6F^\circ$ $^4P^\circ$ $^4D^\circ$ $^4F^\circ$	^6S ^6P ^6D ^6F ^6G ^4S ^4P ^4D ^4F ^4G	------ ------
$5d^6(^3F)nx$	^4F ^2F	$^4D^\circ$ $^4F^\circ$ $^4G^\circ$ $^2D^\circ$ $^2F^\circ$ $^2G^\circ$	^4P ^4D ^4F ^4G ^4H ^2P ^2D ^2F ^2G ^2H	------ ------
$5d^6(^3H)nx$	^4H ^2H	$^4G^\circ$ $^4H^\circ$ $^4I^\circ$ $^2G^\circ$ $^2H^\circ$ $^2I^\circ$	^4F ^4G ^4H ^4I ^4K ^2F ^2G ^2H ^2I ^2K	------ ------
$5d^6(^3G)nx$	^4G ^2G	$^4F^\circ$ $^4G^\circ$ $^4H^\circ$ $^2F^\circ$ $^2G^\circ$ $^2H^\circ$	^4D ^4F ^4G ^4H ^4I ^2D ^2F ^2G ^2H ^2I	------ ------
$5d^6(^3P)nx$	^4P ^2P	$^4S^\circ$ $^4P^\circ$ $^4D^\circ$ $^2S^\circ$ $^2P^\circ$ $^2D^\circ$	^4P ^4D ^4F ^2P ^2D ^2F	------ ------
$5d^6(^3D)nx$	^4D ^2D	$^4P^\circ$ $^4D^\circ$ $^4F^\circ$ $^2P^\circ$ $^2D^\circ$ $^2F^\circ$	^4S ^4P ^4D ^4F ^4G ^2S ^2P ^2D ^2F ^2G	------ ------
$5d^4\ 6s^2(^5D)nx$	^6D ^4D	$^6P^\circ$ $^6D^\circ$ $^6F^\circ$ $^4P^\circ$ $^4D^\circ$ $^4F^\circ$	^6S ^6P ^6D ^6F ^6G ^4S ^4P ^4D ^4F ^4G	------ ------
$5d^5\ 6s(^5S)nx$	^6S ^4S	$^6P^\circ$ $^4P^\circ$	^6D ^4D	------ ------
$5d^5\ 6s(^5G)nx$	^6G ^4G	$^6F^\circ$ $^6G^\circ$ $^6H^\circ$ $^4F^\circ$ $^4G^\circ$ $^4H^\circ$	^6D ^6F ^6G ^6H ^6I ^4D ^4F ^4G ^4H ^4I	------ ------
$5d^5\ 6s(^5P)nx$	^6P ^4P	$^6S^\circ$ $^6P^\circ$ $^6D^\circ$ $^4S^\circ$ $^4P^\circ$ $^4D^\circ$	^6P ^6D ^6F ^4P ^4D ^4F	------ ------
$5d^5\ 6s(^5F)nx$	^6F ^4F	$^6D^\circ$ $^6F^\circ$ $^6G^\circ$ $^4D^\circ$ $^4F^\circ$ $^4G^\circ$	^6P ^6D ^6F ^6G ^6H ^4P ^4D ^4F ^4G ^4H	------

TABLE 20. PREDICTED TERMS OF THE Os I ISOELECTRONIC SEQUENCE

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}$ $4s^2\,4p^6\,4d^{10}\,4f^{14}\,5s^2\,5p^6+$	Predicted Terms			
$5d^6\,6s^2$	^5D ^3P ^3D ^3F ^3G ^3H ^3P ^3F ^1S ^1D ^1F ^1G ^1I ^1S ^1D ^1G			
$5d^8$	^3P ^3F ^1S ^1D ^1G			
	ns $(n \geq 6)$	np $(n \geq 6)$	nd $(n \geq 6)$	......
$5d^6\,6s(^6D)nx$	^7D ^5D	$^7P^\circ$ $^7D^\circ$ $^7F^\circ$ $^5P^\circ$ $^5D^\circ$ $^5F^\circ$	^7S ^7P ^7D ^7F ^7G ^5S ^5P ^5D ^5F ^5G	....
$5d^7(^4F)nx$	^5F ^3F	$^5D^\circ$ $^5F^\circ$ $^5G^\circ$ $^3D^\circ$ $^3F^\circ$ $^3G^\circ$	^5P ^5D ^5F ^5G ^5H ^3P ^3D ^3F ^3G ^3H	....
$5d^7(^4P)nx$	^5P ^3P	$^5S^\circ$ $^5P^\circ$ $^5D^\circ$ $^3S^\circ$ $^3P^\circ$ $^3D^\circ$	^5P ^5D ^5F ^3P ^3D ^3F	....
$5d^7(^2H)nx$	^3H ^1H	$^3G^\circ$ $^3H^\circ$ $^3I^\circ$ $^1G^\circ$ $^1H^\circ$ $^1I^\circ$	^3F ^3G ^3H ^3I ^3K ^1F ^1G ^1H ^1I ^1K	....
$5d^7(^2G)nx$	^3G ^1G	$^3F^\circ$ $^3G^\circ$ $^3H^\circ$ $^1F^\circ$ $^1G^\circ$ $^1H^\circ$	^3D ^3F ^3G ^3H ^3I ^1D ^1F ^1G ^1H ^1I	....
$5d^7(^2F)nx$	^3F ^1F	$^3D^\circ$ $^3F^\circ$ $^3G^\circ$ $^1D^\circ$ $^1F^\circ$ $^1G^\circ$	^3P ^3D ^3F ^3G ^3H ^1P ^1D ^1F ^1G ^1H	....
$5d^7(^2D)nx$	^3D ^1D	$^3P^\circ$ $^3D^\circ$ $^3F^\circ$ $^1P^\circ$ $^1D^\circ$ $^1F^\circ$	^3S ^3P ^3D ^3F ^3G ^1S ^1P ^1D ^1F ^1G	....
$5d^7(^2P)nx$	^3P ^1P	$^3S^\circ$ $^3P^\circ$ $^3D^\circ$ $^1S^\circ$ $^1P^\circ$ $^1D^\circ$	^3P ^3D ^3F ^1P ^1D ^1F	....
$5d^6\,6s(^4D)nx$	^5D ^3D	$^5P^\circ$ $^5D^\circ$ $^5F^\circ$ $^3P^\circ$ $^3D^\circ$ $^3F^\circ$	^5S ^5P ^5D ^5F ^5G ^3S ^3P ^3D ^3F ^3G	....

Table 21. Predicted Terms of the Ir I Isoelectronic Sequence

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6+$	Predicted Terms			
$5d^7\ 6s^2$	^{4}P ^{4}F ^{2}P ^{2}D ^{2}F ^{2}G ^{2}H ^{2}D			
$5d^9$	^{2}D			
	$ns\ (n \geq 6)$	$np\ (n \geq 6)$	$nd\ (n \geq 6)$	......
$5d^8(^3F)nx$	^{4}F ^{2}F	^{4}D° ^{4}F° ^{4}G° ^{2}D° ^{2}F° ^{2}G°	^{4}P ^{4}D ^{4}F ^{4}G ^{4}H ^{2}P ^{2}D ^{2}F ^{2}G ^{2}H	....
$5d^8(^3P)nx$	^{4}P ^{2}P	^{4}S° ^{4}P° ^{4}D° ^{2}S° ^{2}P° ^{2}D°	^{4}P ^{4}D ^{4}F ^{2}P ^{2}D ^{2}F	....
$5d^8(^1G)nx$	^{2}G	^{2}F° ^{2}G° ^{2}H°	^{2}D ^{2}F ^{2}G ^{2}H ^{2}I	......
$5d^8(^1D)nx$	^{2}D	^{2}P° ^{2}D° ^{2}F°	^{2}S ^{2}P ^{2}D ^{2}F ^{2}G	......
$5d^7\ 6s(^5F)nx$	^{6}F ^{4}F	^{6}D° ^{6}F° ^{6}G° ^{4}D° ^{4}F° ^{4}G°	^{6}P ^{6}D ^{6}F ^{6}G ^{6}H ^{4}P ^{4}D ^{4}F ^{4}G ^{4}H	....
$5d^7\ 6s(^5P)nx$	^{6}P ^{4}P	^{6}S° ^{6}P° ^{6}D° ^{4}S° ^{4}P° ^{4}D°	^{6}P ^{6}D ^{6}F ^{4}P ^{4}D ^{4}F	....
$5d^7\ 6s(^3F)nx$	^{4}F ^{2}F	^{4}D° ^{4}F° ^{4}G° ^{2}D° ^{2}F° ^{2}G°	^{4}P ^{4}D ^{4}F ^{4}G ^{4}H ^{2}P ^{2}D ^{2}F ^{2}G ^{2}H	....
$5d^7\ 6s(^3P)nx$	^{4}P ^{2}P	^{4}S° ^{4}P° ^{4}D° ^{2}S° ^{2}P° ^{2}D°	^{4}P ^{4}D ^{4}F ^{2}P ^{2}D ^{2}F	....

Table 22. Predicted Terms of the Pt I Isoelectronic Sequence

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6+$	Predicted Terms		
$5d^8\ 6s^2$	^{3}P ^{3}F ^{1}S ^{1}D ^{1}G		
$5d^{10}$	^{1}S		
	$ns\ (n \geq 6)$	$np\ (n \geq 6)$	
$5d^9(^2D)nx$	^{3}D ^{1}D	^{3}P° ^{3}D° ^{3}F° ^{1}P° ^{1}D° ^{1}F°	
$5d^8\ 6s(^4F)nx'$	^{5}F ^{3}F	^{5}D° ^{5}F° ^{5}G° ^{3}D° ^{3}F° ^{3}G°	
$5d^8\ 6s(^4P)nx''$	^{5}P ^{3}P	^{5}S° ^{5}P° ^{5}D° ^{3}S° ^{3}P° ^{3}D°	
$5d^8\ 6s(^2F)nx'''$	^{3}F ^{1}F	^{3}D° ^{3}F° ^{3}G° ^{1}D° ^{1}F° ^{1}G°	
	$nd\ (n \geq 6)$	$nf\ (n \geq 4)$	....
$5d^9(^2D)nx$	^{3}S ^{3}P ^{3}D ^{3}F ^{3}G ^{1}S ^{1}P ^{1}D ^{1}F ^{1}G	^{3}P° ^{3}D° ^{3}F° ^{3}G° ^{3}H° ^{1}P° ^{1}D° ^{1}F° ^{1}G° ^{1}H°	....
$5d^8\ 6s(^4F)nx'$	^{5}P ^{5}D ^{5}F ^{5}G ^{5}H ^{3}P ^{3}D ^{3}F ^{3}G ^{3}H	^{5}S° ^{5}P° ^{5}D° ^{5}F° ^{5}G° ^{5}H° ^{5}I° ^{3}S° ^{3}P° ^{3}D° ^{3}F° ^{3}G° ^{3}H° ^{3}I°	....
$5d^8\ 6s(^4P)nx''$	^{5}P ^{5}D ^{5}F ^{3}P ^{3}D ^{3}F	^{5}D° ^{5}F° ^{5}G° ^{3}D° ^{3}F° ^{3}G°	....
$5d^8\ 6s(^2F)nx'''$	^{3}P ^{3}D ^{3}F ^{3}G ^{3}H ^{1}P ^{1}D ^{1}F ^{1}G ^{1}H	^{3}S° ^{3}P° ^{3}D° ^{3}F° ^{3}G° ^{3}H° ^{3}I° ^{1}S° ^{1}P° ^{1}D° ^{1}F° ^{1}G° ^{1}H° ^{1}I°	....

TABLE 23. PREDICTED TERMS OF THE Au I ISOELECTRONIC SEQUENCE

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,4f^{14}\,5s^2\,5p^6+$	Predicted Terms			
$5d^9\,6s^2$	^{2}D			
	ns ($n \geq 6$)	np ($n \geq 6$)	nd ($n \geq 6$)	
$5d^{10}(^1S)nx$	^{2}S	^{2}P°	^{2}D	
$5d^9\,6s(^3D)nx'$	^{4}D ^{2}D	^{4}P° ^{4}D° ^{4}F° ^{2}P° ^{2}D° ^{2}F°	^{4}S ^{4}P ^{4}D ^{4}F ^{4}G ^{2}S ^{2}P ^{2}D ^{2}F ^{2}G	
$5d^9\,6s(^1D)nx''$	^{2}D	^{2}P° ^{2}D° ^{2}F°	^{2}S ^{2}P ^{2}D ^{2}F ^{2}G	
	nf ($n \geq 5$)		ng ($n \geq 5$)	---------
$5d^{10}(^1S)nx$		^{2}F°	^{2}G	---------
$5d^9\,6s(^3D)nx'$	^{4}P° ^{4}D° ^{2}P° ^{2}D°	^{4}F° ^{4}G° ^{4}H° ^{2}F° ^{2}G° ^{2}H°	^{4}D ^{4}F ^{4}G ^{4}H ^{4}I ^{2}D ^{2}F ^{2}G ^{2}H ^{2}I	--------- ---------
$5d^9\,6s(^1D)nx''$	^{2}P° ^{2}D°	^{2}F° ^{2}G° ^{2}H°	^{2}D ^{2}F ^{2}G ^{2}H ^{2}I	---------

TABLE 24. PREDICTED TERMS OF THE Hg I ISOELECTRONIC SEQUENCE

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,4f^{14}\,5s^2\,5p^6+$	Predicted Terms			
$5d^{10}\,6s^2$	^{1}S			
$5d^{10}\,6p^2$	^{3}P ^{1}S ^{1}D			
$5d^{10}\,6d^2$	^{3}P ^{3}F ^{1}S ^{1}D ^{1}G			
	ns ($n \geq 6$)	np ($n \geq 6$)	nd ($n \geq 6$)	
$5d^{10}\,6s(^2S)nx$	^{3}S ^{1}S	^{3}P° ^{1}P°	^{3}D ^{1}D	
$5d^9\,6s^2(^2D)nx'$	^{3}D ^{1}D	^{3}P° ^{3}D° ^{3}F° ^{1}P° ^{1}D° ^{1}F°	^{3}S ^{3}D ^{3}F ^{3}G ^{1}S ^{1}D ^{1}F ^{1}G	
$5d^{10}\,6p(^2P°)nx''$	^{3}P° ^{1}P°	^{3}S ^{3}P ^{3}D ^{1}S ^{1}P ^{1}D	[illegible] ^{3}D° ^{3}F° ^{1}P° ^{1}D° ^{1}F°	
	nf ($n \geq 5$)	ng ($n \geq 5$)	nh ($n \geq 6$)	------
$5d^{10}\,6s(^2S)nx$	^{3}F° ^{1}F°	^{3}G ^{1}G	^{3}H° ^{1}H°	------ ------
$5d^9\,6s^2(^2D)nx'$	^{3}P° ^{3}D° ^{3}F° ^{3}G° ^{3}H° ^{1}P° ^{1}D° ^{1}F° ^{1}G° ^{1}H°	^{3}D ^{3}F ^{3}G ^{3}H ^{3}I ^{1}D ^{1}F ^{1}G ^{1}H ^{1}I	^{3}F° ^{3}G° ^{3}H° ^{3}I° ^{3}K° ^{1}F° ^{1}G° ^{1}H° ^{1}I° ^{1}K°	------ ------
$5d^{10}\,6p(^2P°)nx''$	^{3}D ^{3}F ^{3}G ^{1}D ^{1}F ^{1}G	^{3}F° ^{3}G° ^{3}H° ^{1}F° ^{1}G° ^{1}H°	^{3}G ^{3}H ^{3}I ^{1}G ^{1}H ^{1}I	------ ------

Table 25. Predicted Terms of the Tl I Isoelectronic Sequence

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^{10}+$	Predicted Terms															
$6s^2(^1S)6p$	$^2P^\circ$															
$6s\ 6p^2$	^4P															
	^2S	^2P	^2D													
$6p^3$	$^4S^\circ$															
		$^2P^\circ$	$^2D^\circ$													
	$ns\ (n \geq 7)$	$np\ (n \geq 7)$			$nd\ (n \geq 6)$			$nf\ (n \geq 5)$			$ng\ (n \geq 5)$			--------		
$6s^2(^1S)ns$	^2S		$^2P^\circ$			^2D			$^2F^\circ$			^2G		--------		
$6s\ 6p(^3P^\circ)ns'$	$^4P^\circ$	^4S	^4P	^4D	$^4P^\circ$	$^4D^\circ$	$^4F^\circ$	^4D	^4F	^4G	$^4F^\circ$	$^4G^\circ$	$^4H^\circ$	--------		
	$^2P^\circ$	^2S	^2P	^2D	$^2P^\circ$	$^2D^\circ$	$^2F^\circ$	^2D	^2F	^2G	$^2F^\circ$	$^2G^\circ$	$^2H^\circ$	--------		
$6s\ 6p(^1P^\circ)ns''$	$^2P^\circ$	^2S	^2P	^2D	$^2P^\circ$	$^2D^\circ$	$^2F^\circ$	^2D	^2F	^2G	$^2F^\circ$	$^2G^\circ$	$^2H^\circ$	--------		

Table 26. Predicted Terms of the Pb I Isoelectronic Sequence

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^{10}+$	Predicted Terms											
$6s^2\ 6p^2$		^3P										
	^1S		^1D									
$6s\ 6p^3$	$^5S^\circ$											
	$^3S^\circ$	$^3P^\circ$	$^3D^\circ$									
		$^1P^\circ$	$^1D^\circ$									
	$ns\ (n \geq 7)$	$np\ (n \geq 7)$			$nd\ (n \geq 6)$			$nf\ (n \geq 5)$			--------	
$6s^2\ 6p(^2P^\circ)nx$	$^3P^\circ$	^3S	^3P	^3D	$^3P^\circ$	$^3D^\circ$	$^3F^\circ$	^3D	^3F	^3G	--------	
	$^1P^\circ$	^1S	^1P	^1D	$^1P^\circ$	$^1D^\circ$	$^1F^\circ$	^1D	^1F	^1G	--------	
$6s\ 6p^2(^4P)nx$	^5P	$^5S^\circ$	$^5P^\circ$	$^5D^\circ$	^5P	^5D	^5F	$^5D^\circ$	$^5F^\circ$	$^5G^\circ$	--------	
	^3P	$^3S^\circ$	$^3P^\circ$	$^3D^\circ$	^3P	^3D	^3F	$^3D^\circ$	$^3F^\circ$	$^3G^\circ$	--------	

TABLE 27. PREDICTED TERMS OF THE Bi I ISOELECTRONIC SEQUENCE

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6$ $3d^{10}\,4s^2\,4p^6\,4d^{10}$ $4f^{14}\,5s^2\,5p^6\,5d^{10}+$	Predicted Terms				
$6s^2\,6p^3$	$^4S^\circ$ $^2P^\circ$ $^2D^\circ$				
$6s\,6p^4$	^2S ^4P ^2P ^2D				
$6p^5$	$^2P^\circ$				
	$ns\ (n \geq 7)$	$np\ (n \geq 7)$	$nd\ (n \geq 6)$	$nf\ (n \geq 5)$	--------
$6s^2\,6p^2(^3P)nx$	^4P ^2P	$^4S^\circ$ $^2S^\circ$ $^4P^\circ$ $^2P^\circ$ $^4D^\circ$ $^2D^\circ$	^4P ^2P ^4D ^2D ^4F ^2F	$^4D^\circ$ $^2D^\circ$ $^4F^\circ$ $^2F^\circ$ $^4G^\circ$ $^2G^\circ$	-------- --------
$6s^2\,6p^2(^1D)nx'$	^2D	$^2P^\circ$ $^2D^\circ$ $^2F^\circ$	^2S ^2P ^2D ^2F ^2G	$^2P^\circ$ $^2D^\circ$ $^2F^\circ$ $^2G^\circ$ $^2H^\circ$	--------
$6s^2\,6p^2(^1S)nx'$	^2S	$^2P^\circ$	^2D	$^2F^\circ$	--------

TABLE 28. PREDICTED TERMS OF THE Po I ISOELECTRONIC SEQUENCE

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6$ $3d^{10}\,4s^2\,4p^6\,4d^{10}$ $4f^{14}\,5s^2\,5p^6\,5d^{10}+$	Predicted Terms			
$6s^2\,6p^4$	^1S ^3P ^1D			
$6s\,6p^5$	$^3P^\circ$ $^1P^\circ$			
	$ns\ (n \geq 7)$	$np\ (n \geq 7)$	$nd\ (n \geq 6)$	------
$6s^2\,6p^3(^4S^\circ)nx$	$^5S^\circ$ $^3S^\circ$	^5P ^3P	$^5D^\circ$ $^3D^\circ$	------ ------
$6s^2\,6p^3(^2D^\circ)nx'$	$^3D^\circ$ $^1D^\circ$	^3P ^1P ^3D ^1D ^3F ^1F	$^3S^\circ$ $^1S^\circ$ $^3P^\circ$ $^1P^\circ$ $^3D^\circ$ $^1D^\circ$ $^3F^\circ$ $^1F^\circ$ $^3G^\circ$ $^1G^\circ$	------ ------
$6s^2\,6p^3(^2P^\circ)nx''$	$^3P^\circ$ $^1P^\circ$	^3S ^1S ^3P ^1P ^3D ^1D	$^3P^\circ$ $^1P^\circ$ $^3D^\circ$ $^1D^\circ$ $^3F^\circ$ $^1F^\circ$	------ ------

TABLE 29. PREDICTED TERMS OF THE At I ISOELECTRONIC SEQUENCE

$1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,4f^{14}\,5s^2\,5p^6\,5d^{10}$	Predicted Terms			
$6s^2\,6p^5$	$^2P^\circ$			
$6s\,6p^6$	^2S			
	$ns\ (n \geq 7)$	$np\ (n \geq 7)$	$nd\ (n \geq 6)$	------
$6s^2\,6p^4(^3P)nx$	^4P ^2P	$^4S^\circ$ $^4P^\circ$ $^4D^\circ$ $^2S^\circ$ $^2P^\circ$ $^2D^\circ$	^4P ^4D ^4F ^2P ^2D ^2F	------ ------
$6s^2\,6p^4(^1D)nx'$	^2D	$^2P^\circ$ $^2D^\circ$ $^2F^\circ$	^2S ^2P ^2D ^2F ^2G	------

TABLE 30. PREDICTED TERMS OF THE Rn I ISOELECTRONIC SEQUENCE

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,4f^{14}\,5s^2\,5p^6\,5d^{10}+$	Predicted Terms				
$6s^2\,6p^6$	^1S				
	$ns\ (n \geq 7)$	$np\ (n \geq 7)$	$nd\ (n \geq 6)$	$nf\ (n \geq 5)$	--------
$6s^2\,6p^5(^2P^\circ)nx$	$^3P^\circ$ $^1P^\circ$	^3S ^3P ^3D ^1S ^1P ^1D	$^3P^\circ$ $^3D^\circ$ $^3F^\circ$ $^1P^\circ$ $^1D^\circ$ $^1F^\circ$	^3D ^3F ^3G ^1D ^1F ^1G	-------- --------
$6s\,6p^6(^2S)nx'$	^3S ^1S	$^3P^\circ$ $^1P^\circ$	^3D ^1D	$^3F^\circ$ $^1F^\circ$	-------- --------

Jl–Coupling Notation

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,4f^{14}\,5s^2\,5p^6\,5d^{10}\,6s^2+$	Predicted Pairs				
	$ns\ (n \geq 7)$	$np\ (n \geq 7)$	$nd\ (n \geq 6)$	$nf\ (n \geq 5)$	--------
$6p^5(^2P^\circ_{1\frac{1}{2}})nx$	$[1\frac{1}{2}]^\circ$	$[0\frac{1}{2}]$ $[2\frac{1}{2}]$ $[1\frac{1}{2}]$	$[0\frac{1}{2}]^\circ$ $[3\frac{1}{2}]^\circ$ $[1\frac{1}{2}]^\circ$ $[2\frac{1}{2}]^\circ$	$[1\frac{1}{2}]$ $[4\frac{1}{2}]$ $[2\frac{1}{2}]$ $[3\frac{1}{2}]$	-------- -------- -------- --------
$6p^5(^2P^\circ_{\frac{1}{2}})nx'$	$[0\frac{1}{2}]^\circ$	$[1\frac{1}{2}]$ $[0\frac{1}{2}]$	$[2\frac{1}{2}]^\circ$ $[1\frac{1}{2}]^\circ$	$[2\frac{1}{2}]$ $[3\frac{1}{2}]$	-------- --------

TABLE 31. PREDICTED TERMS OF THE Ra I ISOELECTRONIC SEQUENCE

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^{10}\ 6s^2\ 6p^6+$	Predicted terms		
$7s^2$	^1S		
$6d^2$	^3P ^3F ^1S ^1D ^1G		
$7p^2$	^3P ^1S ^1D		
	ns ($n\geq7$)	np ($n\geq7$)	nd ($n\geq6$)
$7s(^2S)ns$	^3S ^1S	$^3P^\circ$ $^1P^\circ$	^3D ^1D
$6d(^2D)ns'$	^3D ^1D	$^3P^\circ$ $^3D^\circ$ $^3F^\circ$ $^1P^\circ$ $^1D^\circ$ $^1F^\circ$	^3S ^3P ^3D ^3F ^3G ^1S ^1P ^1D ^1F ^1G
$7p(^2P^\circ)ns''$	$^3P^\circ$ $^1P^\circ$	^3S ^3P ^3D ^1S ^1P ^1D	$^3P^\circ$ $^3D^\circ$ $^3F^\circ$ $^1P^\circ$ $^1D^\circ$ $^1F^\circ$
	nf ($n\geq5$)	ng ($n\geq5$)	--------
$7s(^2S)nx$	$^3F^\circ$ $^1F^\circ$	^3G ^1G	-------- --------
$6d(^2D)nx'$	$^3P^\circ$ $^3D^\circ$ $^3F^\circ$ $^3G^\circ$ $^3H^\circ$ $^1P^\circ$ $^1D^\circ$ $^1F^\circ$ $^1G^\circ$ $^1H^\circ$	^3D ^3F ^3G ^3H ^3I ^1D ^1F ^1G ^1H ^1I	-------- --------
$7p(^2P^\circ)nx''$	^3D ^3F ^3G ^1D ^1F ^1G	$^3F^\circ$ $^3G^\circ$ $^3H^\circ$ $^1F^\circ$ $^1G^\circ$ $^1H^\circ$	-------- --------

TABLE 32. PREDICTED TERMS OF THE Ac I ISOELECTRONIC SEQUENCE

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^{10}\ 6s^2\ 6p^6+$	Predicted Terms			
$6d\ 7s^2$	^2D			
$6d^3$	^4P ^4F ^2P ^2D ^2F ^2G ^2H ^2D			
	ns ($n\geq7$)	np ($n\geq7$)	nd ($n\geq6$)	------
$7s^2(^1S)ns$	^2S	$^2P^\circ$	^2D	------
$6d\ 7s(^3D)ns$	^4D ^2D	$^4P^\circ$ $^4D^\circ$ $^4F^\circ$ $^2P^\circ$ $^2D^\circ$ $^2F^\circ$	^4S ^4P ^4D ^4F ^4G ^2S ^2P ^2D ^2F ^2G	------ ------
$6d\ 7s(^1D)ns$	^2D	$^2P^\circ$ $^2D^\circ$ $^2F^\circ$	^2S ^2P ^2D ^2F ^2G	------
$6d^2(^3F)ns$	^4F ^2F	$^4D^\circ$ $^4F^\circ$ $^4G^\circ$ $^2D^\circ$ $^2F^\circ$ $^2G^\circ$	^4P ^4D ^4F ^4G ^4H ^2P ^2D ^2F ^2G ^2H	------ ------
$6d^2(^3P)ns$	^4P ^2P	$^4S^\circ$ $^4P^\circ$ $^4D^\circ$ $^2S^\circ$ $^2P^\circ$ $^2D^\circ$	^4P ^4D ^4F ^2P ^2D ^2F	------ ------

Table 33. References to Rare-Earth Spectra

The numbers in the table indicate the references in the bibliography below

Z	El	Spectrum I	Spectrum II	Spectrum III	Spectrum IV	Spectrum VI
58	Ce		1, 2, 10, 31, ‖			
59	Pr	3, 12	3, 31			
60	Nd	17, 31, 32	17, 28, 31, 32			
62	Sm	9				
64	Gd	17, 30	30			
68	Er	12	12, 35			
71	Lu	8, 20	7			
90	Th	12, 31	17, 22, 31	19, 29	18, 21	
92	U	6, 15, 16, 31, 33, 34	5, 6, 22, 31, 32, 33, 34			18
94	Pu	4, 12§, 23§	4, 14			
95	Am	12, 13	12, 13			
96	Cm	11				

§Paper refers to the spectra of the element, in general.

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Table 34. The Chemical Elements—Ionization Potentials

Volume I

Z	Element	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX
		Spectrum																		
1	H	13.595																		
2	He	24.581	54.403																	
3	Li	5.390	75.619	122.419																
4	Be	9.320	18.206	153.850	217.657															
5	B	8.296	25.149	37.920	259.298	340.127														
6	C	11.256	24.376	47.871	64.476	391.986	489.84													
7	N	14.53	29.593	47.426	77.450	97.863	551.925	666.83												
8	O	13.614	35.108	54.886	77.394	113.873	138.080	739.114	871.12											
9	F	17.418	34.98	62.646	87.14	114.214	157.117	185.139	953.60											
10	Ne	21.559	41.07	63.5	97.02	126.3	157.91													
11	Na	5.138	47.29	71.65	98.88	138.37	172.09	208.444	264.155	299.78										
12	Mg	7.644	15.031	80.12	109.29	141.23	186.49	224.90	265.957	327.90	367.36	1761.2								
13	Al	5.984	18.823	28.44	119.96	153.77	190.42	241.38	284.53	330.1	398.5	441.9	2085.5							
14	Si	8.149	16.34	33.46	45.13	166.73	205.11	246.41	303.07	350.96	401.3	476.0	523.2							
15	P	10.484	19.72	30.156	51.354	65.007	220.414	263.31	309.26	371.6	424.3	479.4	560.3	611.4						
16	S	10.357	23.4	35.0	47.29	72.5	88.029	280.99	328.80	378.95	447									
17	Cl	13.01	23.80	39.90	53.5	67.80	96.7	114.27	348.3	400.7	455.3	530.9								
18	Ar	15.755	27.62	40.90	59.79	75.0	91.3	124.0	143.46	422.6										
19	K	4.339	31.81	46	60.90	82.6	99.7	118	155	175.94	503.8									
20	Ca	6.111	11.868	51.21	67	84.39	109	128	143.3	188	211.3	591.9	655							
21	Sc	6.54	12.80	24.75	73.9	92	111	139	159	180	226	250	687							
22	Ti	6.82	13.57	27.47	43.24	99.8	120	141	172	193	217	266	291	788						
23	V	6.74	14.65	29.31	48	65	129	151	174	-------	-------	-------	309	336	897					

Volume II

Z	Element	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX
24	Cr	6.764	16.49	30.95	50	73	91	161	185	210	-------	-------	-------	355	384	1013				
25	Mn	7.432	15.636	33.69	-------	76	-------	119	196	223	248	-------	-------	-------	404	435	1136			
26	Fe	7.87	16.18	30.642	-------	-------	-------	-------	151	235	262	290	-------	355	390	457	489	1266		
27	Co	7.86	17.05	33.49	-------	-------	-------	-------	-------	-------	-------	305	-------	-------	-------	-------	512	547	1403	
28	Ni	7.633	18.15	35.16	-------	-------	-------	-------	-------	-------	-------	-------	350	-------	-------	455	-------	-------	607	
29	Cu	7.724	20.29	36.83	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	671
30	Zn	9.391	17.96	39.70																
31	Ga	6.00	20.51	30.70	64.2															
32	Ge	7.88	15.93	34.21	45.7	93.4														
33	As	9.81	18.63	28.34	50.1	62.6	127.5													
34	Se	9.75	21.5	32	43	68	82	155												
35	Br	11.84	21.6	35.9	47.3	59.7	88.6	103	193											
36	Kr	13.996	24.56	36.9																
37	Rb	4.176	27.5	40	-------	-------	-------	-------	-------	-------	277									
38	Sr	5.692	11.027	-------	57	-------	-------	-------	-------	-------	-------	224								
39	Y	6.38	12.23	20.5	-------	77	-------	-------	-------	-------	-------	-------	374							
40	Zr	6.84	13.13	22.98	34.33	-------	99													
41	Nb	6.88	14.32	25.04	38.3	50	103	125												

Z	Element	I	II	III	IV	V	VI	VII	VIII		XVI	XVII	XVIII	XIX	XX	XXI	XXII	XXIII	XXIV
		Spectrum																	
42	Mo	7.10	16.15	27.13	46.4	61.2	68	126	153										
43	Tc	7.28	15.26																
44	Ru	7.364	16.76	28.46															
45	Rh	7.46	18.07	31.05															
46	Pd	8.33	19.42	32.92															
47	Ag	7.574	21.48	34.82															
48	Cd	8.991	16.904	37.47															
49	In	5.785	18.86	28.03	54.4														
50	Sn	7.342	14.628	30.49	40.72	72.3													
51	Sb	8.639	16.5	25.3	44.1	56	108												
52	Te	9.01	18.6	31	38	60	72	137											
53	I	10.454	19.09						170										
54	Xe	12.127	21.2	32.1															
55	Cs	3.893	25.1																
56	Ba	5.210	10.001																
57	La**	5.61	11.43	19.17															
72	Hf	7	14.9																
73	Ta	7.88	16.2																
74	W	7.98	17.7																
75	Re	7.87	16.6																
76	Os	8.7	17																
77	Ir	9																	
78	Pt	9.0	18.56																
79	Au	9.22	20.5																
80	Hg	10.43	18.751	34.2															
81	Tl	6.106	20.42	29.8	50.7														
82	Pb	7.415	15.028	31.93	42.31	68.8													
83	Bi	7.287	16.68	25.56	45.3	56.0	88.3												
84	Po	8.43																	
85	At																		
86	Rn	10.746																	
87	Fr																		
88	Ra	5.277	10.144																
89	Ac	6.9	12.1	20?															

Table 35. Chemical Symbols

Symbol	Element	Z	Symbol	Element	Z	Symbol	Element	Z	Symbol	Element	Z
Ac	Actinium	89	Er	Erbium	68	Mg	Magnesium	12	Rn	Radon	86
Ag	Silver	47	Es	Einsteinium	99	Mn	Manganese	25	Ru	Ruthenium	44
Al	Aluminum	13	Eu	Europium	63	Mo	Molybdenum	42	S	Sulfur	16
Am	Americium	95	F	Fluorine	9	N	Nitrogen	7	Sb	Antimony	51
Ar	Argon	18	Fe	Iron	26	Na	Sodium	11	Sc	Scandium	21
As	Arsenic	33	Fm	Fermium	100	Nb	Niobium	41	Se	Selenium	34
At	Astatine	85	Fr	Francium	87	Nd	Neodymium	60	Si	Silicon	14
Au	Gold	79	Ga	Gallium	31	Ne	Neon	10	Sm	Samarium	62
B	Boron	5	Gd	Gadolinium	64	Ni	Nickel	28	Sn	Tin	50
Ba	Barium	56	Ge	Germanium	32	No	Nobelium	102	Sr	Strontium	38
Be	Beryllium	4	H	Hydrogen		Np	Neptunium	93	Ta	Tantalum	73
Bi	Bismuth	83	(D	Deuterium)	1	O	Oxygen	8	Tb	Terbium	65
Bk	Berkelium	97	(T	Tritium)		Os	Osmium	76	Tc	Technetium	43
Br	Bromine	35	He	Helium	2	P	Phosphorus	15	Te	Tellurium	52
C	Carbon	6	Hf	Hafnium	72	Pa	Protactinium	91	Th	Thorium	90
Ca	Calcium	20	Hg	Mercury	80	Pb	Lead	82	Ti	Titanium	22
Cd	Cadmium	48	Ho	Holmium	67	Pd	Palladium	46	Tl	Thallium	81
Ce	Cerium	58	I	Iodine	53	Pm	Promethium	61	Tm	Thulium	69
Cf	Californium	98	In	Indium	49	Po	Polonium	84	U	Uranium	92
Cl	Chlorine	17	Ir	Iridium	77	Pr	Praseodymium	59	V	Vanadium	23
Cm	Curium	96	K	Potassium	19	Pt	Platinum	78	W	Wolfram	74
Co	Cobalt	27	Kr	Krypton	36	Pu	Plutonium	94	Xe	Xenon	54
Cr	Chromium	24	La	Lanthanum	57	Ra	Radium	88	Y	Yttrium	39
Cs	Cesium	55	Li	Lithium	3	Rb	Rubidium	37	Yb	Ytterbium	70
Cu	Copper	29	Lu	Lutetium	71	Re	Rhenium	75	Zn	Zinc	30
Dy	Dysprosium	66	Md	Mendelevium	101	Rh	Rhodium	45	Zr	Zirconium	40

TABLE 36. THE PERIODIC SYSTEM‡

Period	Subshell	Elements
1	1s	H 1, He 2
2	2s	Li 3, Be 4
	2p	B 5, C 6, N 7, O 8, F 9, Ne 10
3	3s	Na 11, Mg 12
	3p	Al 13, Si 14, P 15, S 16, Cl 17, Ar 18
4	{4s	K 19, Ca 20
	3d}	Sc 21, Ti 22, V 23, Cr 24, Mn 25, Fe 26, Co 27, Ni 28, Cu 29, Zn 30
	4p	Ga 31, Ge 32, As 33, Se 34, Br 35, Kr 36
5	{5s	Rb 37, Sr 38
	4d}	Y 39, Zr 40, Nb 41, Mo 42, Tc 43, Ru 44, Rh 45, Pd 46, Ag 47, Cd 48
	5p	In 49, Sn 50, Sb 51, Te 52, I 53, Xe 54
6	{6s	Cs 55, Ba 56
	4f	La 57, Ce 58, Pr 59, Nd 60, Pm 61, Sm 62, Eu 63, Gd 64, Tb 65, Dy 66, Ho 67, Er 68, Tm 69, Yb 70
	5d}	Lu 71, Hf 72, Ta 73, W 74, Re 75, Os 76, Ir 77, Pt 78, Au 79, Hg 80
	6p	Tl 81, Pb 82, Bi 83, Po 84, At 85, Rn 86
7	{7s	Fr 87, Ra 88
	5f	Ac 89, Th 90, Pa 91, U 92, Np 93, Pu 94, Am 95, Cm 96, Bk 97, Cf 98, Es 99, Fm 100, Md 101, No 102
	6d}	103, 104, 105, 106, 107, 108, 109, 110, 111, 112

‡This arrangement is by Catalán. See J. Cabrera, Fisica general Zaragosa, Spain (1950). The electrons indicated in column 2 that are connected by braces have approximately the same binding energy. Consequently, for some elements one type of electron is preferred over another in the normal configuration, as for example, Cr, Nb, Pd, La, Ac, Th.

Table 37. Index—Isoelectronic Sequences

[The tabular entries are page numbers]

Z	Element	Spectrum																	
		I	II	III	IV	V	VI	VII	VIII		XVI	XVII	XVIII	XIX	XX	XXI	XXII	XXIII	XXIV
42	Mo	1	7	11	12	13	14	15	15		16								
43	Tc	17	19																
44	Ru	20	25	28															
45	Rh	29	32	34															
46	Pd	38	41	44									47		47				
47	Ag	48	50	52										54		54			
48	Cd	55	58	60	62										63		63		
49	In	64	67	70	71	72										73		73	
50	Sn	74	80	82	83	84	85										86		86
51	Sb	87	90	92	93	94	95											95	
52	Te	96	98	100	101	102	103	104											
53	I	105	108	110	111		111	112	112										
54	Xe	113	118	120	122														
55	Cs	124	128	130															
56	Ba	131	134		135														
57	La**	136	139	142															
72	Hf	143	146																
73	Ta	149	154																
74	W	156	161																
75	Re	164	168																
76	Os	171	176																
77	Ir	177																	
78	Pt	181	183																
79	Au	186	189																
80	Hg	191	196	198	200														
81	Tl	202	204	206	207														
82	Pb	208	211	213	215	217													
83	Bi	219	221	222	223	224	225												
84	Po	227																	
86	Rn	228	230																
88	Ra	231	233																
89	Ac	234	235	237															

MOLYBDENUM

Mo I

42 electrons **Z=42**

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^5\ 5s\ {}^7S_3$

$a\ {}^7S_3$ 57260 K **I. P. 7.10 volts**

The analysis is, for the most part, by Kiess, who started work on Mo I some 35 years ago, when he first became interested in Cr I and Cr II. After the discovery of the first multiplets of Mo I the analysis was postponed because of the need of further observations. About 8 years ago Kiess and Miss Harvey resumed work on a new description of the spectrum including Zeeman observations. The present line list extends from 2000 A to 11850 A, and includes about 7500 lines, of which about 80 percent are classified. The Zeeman observations are from spectrograms made at the Massachusetts Institute of Technology, as well as the National Bureau of Standards. Some observed g-values in the table are means of as many as 10 determinations.

Observed intersystem combinations connect the terms of different multiplicities. It is one of the few spectra in which four multiplicities are known.

In a spectrum as complex as Mo I it is particularly difficult to assign configurations. The low even configurations are discussed in the 1952 paper by Trees and Miss Harvey. The odd ones are tentatively assigned, in many cases. Configuration-interaction and the resulting perturbations complicate the problem. Since the work is still in progress some of the numbers in column three used to designate miscellaneous levels are subject to replacement by term designations. Consequently they do not run continuously.

The limit is well determined by the $ns\ {}^7S$ series of three members (n=5 to 7).

A Monograph on Mo I is nearing completion.

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H. E. Walchli, *A Table of Nuclear Moment Data*, Oak Ridge Nat. Lab., ORNL-1469, Suppl. II, 29 (1955). (Summary hfs)

C. C. Kiess and M. M. Harvey, unpublished material (June 1956). (I P) (T) (C L) (Z E)

Mo I

Config.	Desig.	J	Level	Interval	Obs. g
$4d^5(a\,^6S)5s$	$a\,^7S$	3	0.00		1.992
$4d^5(a\,^6S)5s$	$a\,^5S$	2	10768.33		1.980
$4d^4\,5s^2$	$a\,^5D$	0	10965.97		0.000
		1	11142.83	176.86	1.490
		2	11454.42	311.59	1.498
		3	11858.54	404.12	1.488
		4	12346.31	487.77	1.483
$4d^5(a\,^4G)5s$	$a\,^5G$	2	16641.08		0.331
		3	16692.96	51.88	0.918
		4	16747.73	54.77	1.141
		5	16784.60	36.87	1.284
		6	16783.96	−0.64	1.318
$4d^5(a\,^4P)5s$	$a\,^5P$	3	18229.23		1.636
		2	18356.53	−127.30	1.789
		1	18479.65	−123.12	2.424
$4d^5(a\,^4D)5s$	$b\,^5D$	0	19969.85		−0.037
		1	20130.38	160.53	1.579
		2	20281.03	150.65	1.537
		3	20350.54	69.51	1.495
		4	20157.90	−192.64	1.482
$4d^4\,5s^2$	$a\,^3P$	0	20607.57		0.000
		1	22244.42	1636.85	0.977
		2	22876.02	631.60	1.361
$4d^5(a\,^4D)5s$	$a\,^3D$	1	20930.45		1.056
		2	20950.88	20.43	1.289
		3	21618.60	667.72	1.320
$4d^5(a\,^4G)5s$	$a\,^3G$	3	20947.86		0.767
		4	21153.84	205.98	1.051
		5	21343.15	189.31	1.213
$4d^4\,5s^2$	$a\,^3F$	4	23516.52		1.117
		3	23668.12	−151.60	1.079
		2	23534.46	133.66	0.667
$4d^4\,5s^2$	$a\,^3H$	4	24096.26		0.973
		5	24465.70	369.44	1.128
		6	24823.48	357.78	1.142
$4d^4\,5s^2$	$a\,^1S$	0	24472.06		
$4d^6$	$c\,^5D$	4	25455.58		1.458
		3	25707.15	−251.57	1.355
		2	25794.65?	−87.50	1.09
		1	25820.67	−26.02	
		0	25980.3	−159.6	
$4d^5(a\,^2I)5s$	$a\,^3I$	5	25516.95		0.796
		6	25548.90	31.95	1.028
		7	25638.63	89.73	1.147
$4d^5(a\,^6S)5p$	$z\,^7P^\circ$	2	*25614.31*		2.299
		3	*25871.86*	257.55	1.892
		4	*26320.38*	448.52	1.736
$4d^5(a\,^4F)5s$	$a\,^5F$	5	25905.58		1.394
		4	25997.32	−91.74	1.322
		3	26189.48	−192.16	1.307
		2	26335.87	−146.39	1.031
		1	26283.82	52.05	
$4d^5(a\,^4P)5s$	$b\,^3P$	0	26450.10		
		1	26414.90	−35.20	1.41
		2	27415.27	1000.37	1.41
$4d^4\,5s^2$	$a\,^1G$	4	26635.82		1.014
$4d^5(a\,^2D)5s$	$b\,^3D$	3	26638.84		1.234
		2	26758.70	−119.86	1.24
		1	27362.55	−603.85	1.06

Mo I

Config.	Desig.	J	Level	Interval	Obs. g
$4d^5(a\,^4F)5s$	$b\,^5F$	2	27093.44		0.890
		3	27774.48	681.04	1.055
		4	27765.69	−8.79	1.125
$4d^4\,5s^2$	$b\,^3G$	3	27383.76		0.913
		4	27341.92	−41.84	1.075
		5	27726.73	384.81	1.219
$4d^4\,5s(a\,^6D)5p$	$z\,^7F^\circ$	0	*27866.63*		
		1	*28274.39*	407.76	
		2	*28666.73*	392.34	2.312
		3	*28848.13*	181.40	1.905
		4	*29171.08*	322.95	
		5	*29781.16*	610.08	1.496
		6	*30496.07*	714.91	1.513
$4d^5(a\,^2I)5s$	$a\,^1I$	6	28241.03		1.015
$4d^5(a\,^6S)5p$	$z\,^5P^\circ$	1	*28715.29*		2.500
		2	*28836.60*	121.31	1.831
		3	*28923.66*	87.06	1.664
$4d^5(a\,^2F)5s$	$c\,^3F$	2	2964[illegible].07		1.02
		3	30159.[illegible]	517.66	1.089
		4	30501.98	342.25	1.111
$4d^5(a\,^2H)5s$	$b\,^3H$	4	29842.16		0.864
		5	29981.70	139.54	1.091
		6	30113.07	131.37	1.12
$4d^4\,5s(a\,^6D)5p$	$z\,^7D^\circ$	1	*30846.61*		2.894
		2	*31155.04*	308.43	2.034
		3	*31654.80*	499.76	1.744
		4	*32123.16*	468.36	1.658
		5	*32611.91*	488.75	1.568.
$4d^4\,5s(a\,^6D)5p$	$y\,^7P^\circ$	2	*31299.95*		2.273
		3	*31533.27*	233.32	1.84
		4	*31913.24*	379.97	1.73
$4d^4\,5s^2$	$b\,^1I$	6	31484.60		1.028
$4d^5(a\,^2G)5s$	$c\,^3G$	3			
		4	31510.57		
		5	32279.02	768.45	
$4d^5(a\,^2G)5s$	$b\,^1G$	4	32688.30		0.960
$4d^4\,5s(a\,^6D)5p$	$y\,^5P^\circ$	1	*32898.81*		2.550
		2	*33299.09*	400.28	1.838
		3	*33955.09*	656.00	1.659
$4d^5(a\,^2H)5s$	$a\,^1H$	5	33904.46		1.026
$4d^4\,5s(a\,^6D)5p$	$z\,^5F^\circ$	1	*34248.43*		−0.004
		2	*34434.71*	186.28	1.010
		3	*34740.40*	305.69	1.258
		4	*35169.44*	429.04	1.346
		5	*35719.37*	549.93	1.395
$4d^6$	$c\,^3H$	6	34810.14		1.09
		5	34912.06	−101.92	1.10
		4	35042.06	−130.00	0.79
$4d^4\,5s(a\,^6D)5p$	$z\,^5D^\circ$	0	*37128.14*		0.000
		1	*37293.00*	164.86	1.489
		2	*37579.23*	286.23	1.473
		3	*37968.47*	389.24	1.492
		4	*38423.10*	454.63	1.482
$4d^4\,5s(b\,^4D)5p$	$y\,^5D^\circ$	0	*37365.69*		0.000
		1	*37901.55*	535.86	1.491
		2	*38522.26*	620.71	1.471
		3	*39159.89*	637.63	1.251
		4	*39915.64*	755.75	1.463
	1°	1	*38626.50*		1.443

Mo I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$4d^5(a\,{}^4G)5p$	$z\,{}^5G^\circ$	2	*38983.40*	138.08	0.428
		3	*39121.48*	168.15	1.070
		4	*39289.63*	155.58	
		5	*39445.21*	76.98	
		6	*39522.19*		
$4d^4\,5s(b_4\,{}^4D)5p$	$z\,{}^5P^\circ$	1	*39358.58*	104.16	2.485
		2	*39462.74*	497.80	1.696
		3	*39960.54*		1.282
$4d^6$	$c\,{}^1I$	6	39521.09		0.982
$4d^5(a\,{}^4G)5p$	$z\,{}^5H^\circ$	7	*39600.05*	−35.18	
		6	*39635.23*	−732.11	
		5	*40367.34*	299.67	
		4	*40067.67*	317.74	
		3	*39749.93*		
$4d^5(a\,{}^6S)6s$	$e\,{}^7S$	3	39675.42		1.992
$4d^4\,5s(b_4\,{}^4D)5p$	$z\,{}^3P^\circ$	0			
		1	*39779.89*	41.54	
		2	*39821.43*		1.346
$4d^4\,5s(b_4\,{}^4D)5p$	$z\,{}^3F^\circ$	2	*39989.12?*		1.350
		3			
		4	*40843.53*		1.256
$4d^4\,5s(b\,{}^4D)5p$	$z\,{}^3D^\circ$	1	*40037.01*	529.26	0.781
		2	*40566.27*	397.84	1.160
		3	*40964.11*		1.278
	2°	2	*40240.84*		
$4d^5(a\,{}^4P)5p$	$z\,{}^5D^\circ$	4			
		3	*40488.35*	−340.50	1.470
		2	*40828.85*	130.39	1.474
		1	*40698.46*	−37.54	1.393
		0	*40736.00*		0.000
$4d^5(a\,{}^6S)6s$	$e\,{}^5S$	2	40840.28		
$4d^5(a\,{}^4G)5p$	$y\,{}^5F^\circ$	1	*41011.74?*	20.27	1.235
		2	*41032.01*	192.40	1.053
		3	*41224.41*	171.13	1.259
		4	*41395.54*	−47.83	1.343
		5	*41347.71*		1.385
	3°	1	*41398.43*		1.067
$4d^5(a\,{}^4G)5p$	$y\,{}^3F^\circ$	2	*41484.54*	365.43	0.781
		3	*41849.97*	231.62	1.084
		4	*42081.59*		1.225
$4d^5(a\,{}^4D)5p$	$w\,{}^5D^\circ$	0	*42173.10*	−16.96	0.000
		1	*42156.14*	81.27	1.438
		2	*42237.41*	184.99	1.442
		3	*42422.40*	319.42	1.425
		4	*42741.82*		1.403
$4d^5(a\,{}^4G)5p$	$z\,{}^3H^\circ$	4	*42185.84*	97.39	0.851
		5	*42283.23*	61.75	
		6	*42344.98*		1.258
$4d^5(a\,{}^4G)5p$	$z\,{}^3G^\circ$	3	*42970.06*	226.89	0.884
		4	*43196.95*	748.69	1.097
		5	*43945.64*		1.359
$4d^5(a\,{}^4D)5p$	$x\,{}^5F^\circ$	1			
		2	*43045.53*	200.09	1.030
		3	*43245.62*	284.23	1.248
		4	*43529.85*	−230.77	1.365
		5	*43299.08*		1.363
$4d^4\,5s(a\,{}^4H)5p$	$z\,{}^5I^\circ$	4	*43598.54*	731.69	0.779
		5	*44330.23*		0.956
		6			
		7			
		8			
$4d^4\,5s(a\,{}^4H)5p$	$y\,{}^5H^\circ$	3	*43697.53*	314.82	0.554
		4	*44012.35*	432.16	0.867
		5	*44444.51*	250.42	
		6	*44694.93*	710.97	
		7	*45405.90*		
$4d^4\,5s(a\,{}^4H)5p$	$y\,{}^3G^\circ$	3	*43975.56*	485.07	
		4	*44460.63*	299.11	1.075
		5	*44759.74*		1.170
$4d^5(a\,{}^4D)5p$	$y\,{}^3D^\circ$	1	*44041.09*	483.50	
		2	*44524.59*	396.45	1.123
		3	*44921.04*		
$4d^5(a\,{}^6S)5d$	$e\,{}^7D$	1	44935.78	4.61	
		2	44940.39	6.87	
		3	44947.26	9.95	1.94
		4	44957.21	12.89	1.650
		5	44970.10		1.605
	4°	2	*45388.66*		
$4d^5(a\,{}^2G)5p$	$x\,{}^3G^\circ$	3	*45414.90*	141.38	0.794
		4	*45556.28*	279.24	1.108
		5	*45835.52*		1.100
$4d^4\,5s(b\,{}^4F)5p$	$w\,{}^5F^\circ$	1	*45457.85*	−32.74	0.104
		2	*45425.11*	209.59	1.286
		3	*45634.70*	234.87	1.162
		4	*45869.57*		1.334
		5			
$4d^5(a\,{}^4D)5p$	$x\,{}^3F^\circ$	2	*45710.01*	228.51	0.890
		3	*45938.52*	30.69	1.110
		4	*45969.21*		1.135
$4d^5(a\,{}^6S)5d$	$e\,{}^5D$	4	45785.69	−7.08	
		3	45792.77	−7.39	
		2	45800.16	−5.31	
		1	45805.47	−1.90	
		0	45807.37		
$4d^5(a\,{}^4P)5p$	$z\,{}^3S^\circ$	1	*45834.83*		2.048
$4d^5(a\,{}^4F)5p$	$x\,{}^3D^\circ$	1	*45974.34*	327.44	
		2	*46301.78*	506.69	1.078
		3	*46808.47*		1.275
	5°	4	*46136.03*		
$4d^5(a\,{}^4F)5p$	$v\,{}^5F^\circ$	1	*46447.97*	4.56	
		2	*46452.53*	0.89	
		3	*46453.42*	303.08	
		4	*46756.50*		1.304
		5			
	6°	4	*46590.07*		1.160
	7°	1	*46720.22*		
	8°	2	*46754.90*		
$4d^5(a\,{}^2I)5p$	$z\,{}^3I^\circ$	5	*46861.06*	310.70	0.937
		6	*47171.76*	321.14	1.13
		7	*47492.90*		1.14
$4d^5(a\,{}^2D)5p$	$w\,{}^3F^\circ$	2	*46874.52*	51.88	
		3	*46926.40*		1.093
		4			
$4d^5(a\,{}^2D)5p$	$w\,{}^3D^\circ$	1	*46895.06*	215.18	
		2	*47110.24*	74.34	1.156
		3	*47184.58*		1.290
	9°	3	*46955.84*		1.66
	10°	1	*47038.81*		
	11°	2	*47051.74*		0.917

Mo I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
	12°	3	47064.59		1.13
	13°	3	47177.12		
$4d^4\,5s(b\,^4F)5p$	$y\,^5G^\circ$	2	47186.54?	124.72	
		3	47311.26	98.02	0.862
		4	47409.28	249.75	1.200
		5	47659.03	45.65	1.252
		6	47704.68		1.30
	14°	1	47848.15		1.164
	15°	2	47882.23		
	16°	0	47324.26		0.00
	17°	1	47402.23		0.889
	18°	5	47491.68		1.112
	19°	2	47587.58		1.12
	20°	4	47710.81		1.056
	21°	1	47713.85		
$4d^4\,5s(c\,^4D)5p$	$v\,^3D^\circ$	1	47779.41	305.85	0.076
		2	48085.26	120.69	1.044
		3	48205.95		1.37
	22°	3	47848.40		
$4d^4\,5s(c\,^4D)5p$	$u\,^5F^\circ$	1	48022.23	−195.01	0.29
		2	47827.22	201.00	1.09
		3	48028.22	163.83	1.283
		4	48192.05	355.39	1.293
		5	48547.44		1.370
$4d^5(a\,^2I)5p$	$y\,^3H^\circ$	4	47876.73	312.49	
		5	48189.22	211.04	1.206
		6	48400.26		1.195
	23°	2	48038.89		
	24°	6	48120.58		1.20
$4d^5(a\,^2F)5p$	$v\,^3F^\circ$	2	48238.21	160.79	0.758
		3	48399.00		1.174
		4			
$4d^5(a\,^6S)7s$	$f\,^7S$	3	48367.66		
$4d^4\,5s(c\,^4D)5p$	$v\,^5D^\circ$	0			
		1	48410.88	−2.19	
		2	48408.69	123.41	1.440
		3	48532.10	338.34	1.496
		4	48870.44		1.454
$4d^5(a\,^2G)5p$	$x\,^3H^\circ$	4	48622.08	196.89	0.926
		5	48818.97	242.76	0.972
		6	49061.73		1.108
$4d^5(a\,^6S)7s$	$f\,^5S$	2	48742.20		
	25°	1	48775.48		
$4d^4\,5s(b\,^4G)5p$	$x\,^5G^\circ$	2	48875.84	121.40	
		3	48997.24	149.45	0.60
		4	49146.69	155.29	1.164
		5	49301.98	106.56	1.25
		6	49408.54		1.150
$4d^5(a\,^2I)5p$	$z\,^1H^\circ$	5	48922.21		0.970
	26°	1	48955.80		0.77
	27°	1	49169.31		

Mo I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$4d^4\,5s(b\,^4G)5p$	$t\,^5F^\circ$	1	49189.71	156.59	0.81
		2	49346.30	121.75	1.20
		3	49468.05	122.78	1.216
		4	49590.83	59.85	1.245
		5	49650.68		1.352
	28°	3	49259.38		1.348
$4d^4\,5s(a\,^4H)5p$	$y\,^3I^\circ$	5	49350.60	49.78	0.914
		6	49400.38	164.75	1.108
		7	49565.13		1.122
	29°	4	49369.50		1.475
$4d^4\,5s(b\,^4P)5p$	$w\,^5P^\circ$	1	49484.14	227.72	2.378
		2	49711.86	1498.06	2.16
		3	51209.92		1.66
	30°	5	49595.64		1.008
$4d^4\,5s(a\,^6D)6s$	$f\,^7D$	1	49608.20	244.09	2.990
		2	49852.29	303.21	
		3	50155.50	634.84	
		4	50790.34	485.35	1.613
		5	51275.69		1.611
$4d^5(a\,^4F)5p$	$u\,^3F^\circ$	2	49801.41	−11.58	
		3	49789.83	344.41	1.061
		4	50134.24		1.210
$4d^4\,5s(b\,^4G)5p$	$w\,^3G^\circ$	3			
		4	49863.45	767.90	1.054
		5	50631.35		1.123
	31°	2	49880.46		
$4d^4\,5s(c\,^4D)5p$	$v\,^5P^\circ$	3	49999.49	−1050.11	1.72
		2	51049.60	936.33	1.61
		1	50113.27		2.52
$4d^5(a\,^2I)5p$	$z\,^3K^\circ$	8			
		7	50276.83	−319.10	1.046
		6	50595.93		0.968
$4d^5(a\,^6S)6d$	$g\,^7D$	5	50364.36	40.93	
		4	50323.43	−48.31	
		3	50371.74		
		2			
		1			
	32°	2	50482.46		1.07
	33°	4	50625.18		1.23
	34°	3	50670.03		
	35°	2	50769.72		
	36°	4	50770.12		
	37°	5	50801.61		1.083
	38°	2	50925.56		
$4d^4\,5s(a\,^4H)5p$	$w\,^3H^\circ$	4	50953.80	799.62	0.937
		5	51753.42		1.059
		6			
	39°	1	51070.34		
	40°	1	51165.07		
	41°	4	51234.16		1.26
	42°	2	51404.83		1.675
	43°	4	51585.39		1.040

Mo I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
	44°	2	*51675.27*		1.146
	45°	3	*51808.89*		0.88
	46°	6	*51856.30*		
	47°	4	*51858.82*		1.258
	48°	1	*51876.03*		0.87
	49°	3	*51884.52*		1.13
	50°	2	*51891.30*		0.56
	51°	4	*52085.30*		1.266
	52°	2	*52088.09*		
	53°	3	*52135.63*		0.91
	54°	3	*52182.01*		1.34
	55°	4	*52404.79*		1.16
	56°	2	*52441.17*		
	57°	5	*52441.33*		
	58°	2	*52443.57*		1.12
	59°	5	*52465.36*		1.088
$4d^4 5s(a\,^6D)6s$	$f\,^5D$	0			
		1			
		2			
		3			
		4	52477..60		
	60°	4	*52579.34*		1.055
	61°	5	*52667.27*		1.18
	62°	2	*52740.51*		
	63°	1	*52746.93*		
	64°	3	*52902.26*		
	65°	1	*52941.36*		
	66°	2	*52964.76*		
	67°	4	*53005.71*		1.35
	68°	5	*53112.20*		1.40
	69°	6	*53184.27*		1.04
	70°	5	*53197.79*		1.324
	71°	3	*53226.86*		1.01
	72°	6	*53290.73*		
	73°	3	*53305.79*		
	74°	5	*53327.30*		
	75°	4	*53478.86*		
	76°	1	*53483.00*		
	77°	2	*53588.78*		1.43
	78°	3	*53595.18*		1.18
	79°	7	*53636.76*		1.125
	80°	3	*53643.84*		1.37
	81°	3	*53735.87*		
	82°	4	*53800.48*		1.49
	83°	4	*53855.20*		1.17
	84°	5	*53937.80*		1.14
	85°	4	*53964.53*		1.016
	86°	1	*54184.34*		
	87°	4	*54292.23*		1.04
	88°	1	*54341.00*		
	89°	2	*54342.90*		1.48
	90°	1	*54531.12*		
	91°	1	*54571.76*		0.75
	92°	5	*54704.54*		0.911
	93°	7	*54738.58*		1.10
	94°	3	*54839.36*		0.31
	95°	3	*54889.12*		0.84
	96°	4	*55025.75*		1.050
	97°	5	*55139.74*		0.968
	98°	3	*55327.60*		
	99°	3	*55352.81*		
	100°	5	*55387.34*		1.12
	101°	4	*55529.85*		
	102°	4	*55907.71*		1.09
	103°	5	*55975.93*		1.10
$4d^5(a\,^2H)5p$	$y\,^1H°$	5	*56161.71*		0.96
	104°	3	*56380.79*		0.03
$4d^5(a\,^2H)5p$	$z\,^1I°$	6	*56716.58*		1.00
	105°	6	*56890.71*		1.21
	106°	4	*56945.78*		
	107°	5	*57029.81*		0.98
	108°	3	*57144.26*		
Mo II ($^6S_{2\frac{1}{2}}$)	*Limit*	-----	57260		
	109°	4	*57818.12*		
	110°	4	*58090.10*		
	111°	3	*58192.82*		
	112°	6	*58525.71*		1.15
	113°	5	*58998.62*		0.88
	114°	3	*59236.59*		
	115°	2	*59249.76*		
	116°	5	*59436.61*		1.07
	117°	5	*59612.36*		1.09
	118°	5	*59841.11*		0.930
	119°	6	*60192.00*		
	120°	7	*61470.51*		

June 1956.

Mo I Observed Terms *

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2$ $3p^6\ 3d^{10}\ 4s^2\ 4p^6+$	Observed Terms		
$4d^4\ 5s^2$	$a\ ^1S$ $a\ ^3P$ $a\ ^5D$ $a\ ^3F$ $b\ ^3G$ $a\ ^1G$ $a\ ^3H$ $b\ ^1I$		
$4d^6$	$c\ ^3D$ $c\ ^3H$ $c\ ^1I$		
	$ns\ (n \geq 5)$	$np\ (n \geq 5)$	$nd\ (n \geq 5)$
$4d^5(a\ ^6S)nx$	$a, e, f\ ^7S$ $a, e, f\ ^5S$	$z\ ^7P^\circ$ $z\ ^5P^\circ$	$e, g\ ^7D$ $e\ ^5D$
$4d^4\ 5s(a\ ^6D)nx$	$f\ ^7D$ $f\ ^5D$	$y\ ^7P^\circ$ $z\ ^7D^\circ$ $z\ ^7F^\circ$ $y\ ^5P^\circ$ $z\ ^5D^\circ$ $z\ ^5F^\circ$	
$4d^5(a\ ^4G)nx$	$a\ ^5G$ $a\ ^3G$	$y\ ^5F^\circ$ $z\ ^5G^\circ$ $z\ ^5H^\circ$ $y\ ^3F^\circ$ $z\ ^3G^\circ$ $z\ ^3H^\circ$	
$4d^5(a\ ^4P)nx$	$a\ ^5P$ $b\ ^3P$	$z\ ^5S^\circ$ $z\ ^5D^\circ$	
$4d^5(a\ ^4D)nx$	$b\ ^5D$ $a\ ^3D$	$w\ ^5D^\circ$ $x\ ^5F^\circ$ $y\ ^3D^\circ$ $x\ ^3F^\circ$	
$4d^5(a\ ^2D)nx$	$b\ ^3D$	$w\ ^3D^\circ$ $w\ ^3F^\circ$	
$4d^5(a\ ^2I)nx$	$a\ ^3I$ $a\ ^1I$	$y\ ^3H^\circ$ $z\ ^3I^\circ$ $z\ ^3K^\circ$ $z\ ^1H^\circ$	
$4d^5(a\ ^4F)nx$	$a\ ^5F$ $b\ ^3F$	$v\ ^5F^\circ$ $x\ ^3D^\circ$ $u\ ^3F^\circ$	
$4d^4\ 5s(b\ ^4D)nx$		$x\ ^5P^\circ$ $y\ ^5D^\circ$ $z\ ^3P^\circ$ $z\ ^3D^\circ$ $z\ ^3F^\circ$	
$4d^5(a\ ^2F)nx$	$c\ ^3F$	$v\ ^3F^\circ$	
$4d^4\ 5s(a\ ^4H)nx$		$y\ ^5H^\circ$ $z\ ^5I^\circ$ $y\ ^3G^\circ$ $w\ ^3H^\circ$ $y\ ^3I^\circ$	
$4d^5(a\ ^2G)nx$	$c\ ^3G$ $b\ ^1G$	$x\ ^3G^\circ$ $x\ ^3H^\circ$	
$4d^4\ 5s(b\ ^4P)nx$		$w\ ^5P^\circ$	
$4d^5(a\ ^2H)nx$	$b\ ^3H$ $a\ ^1H$	$y\ ^1H^\circ$ $z\ ^1I^\circ$	
$4d^4\ 5s(b\ ^4F)nx$		$w\ ^5F^\circ$ $y\ ^5G^\circ$	
$4d^4\ 5s(b\ ^4G)nx$		$t\ ^5F^\circ$ $x\ ^5G^\circ$ $w\ ^3G^\circ$	
$4d^4\ 5s(c\ ^4D)nx$		$v\ ^5P^\circ$ $v\ ^5D^\circ$ $u\ ^5F^\circ$ $v\ ^3D^\circ$	

*For predicted terms in the spectra of the Mo I isoelectronic sequence, see Vol. III, Introduction.

Mo II

(Nb I sequence; 41 electrons) $Z=42$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^5\ {}^6S_{2\frac{1}{2}}$

$a\ {}^6S_{2\frac{1}{2}}$ 130300 K I. P. 16.15 volts

Since 1932 no extensive work has been done on Mo II except at the National Bureau of Standards. A detailed description and analysis have been completed by Kiess especially for inclusion here, and a Monograph has been completed.

His observations extend from 2000 A to 6000 A, supplemented by several hundred lines to shorter waves, measured on spectrograms furnished by Boyce and by Shenstone. Altogether, about seventy percent of the known Mo II lines have been classified.

The observed g-values have been derived from Zeeman spectrograms taken at the National Bureau of Standards and at the Massachusetts Institute of Technology.

The limit is from Catalán and Rico, who have interpolated it from data on second spectra from Sr to Cd.

The prefixes a, b of the limit terms of Mo III as given in the table are tentative. The terms of Mo III are very incompletely known, and the prefixes have been arbitrarily assigned for convenience in describing the configurations in Mo II.

The present Monograph by Kiess represents work covering a span of 35 years, culminating in the classification of more than 2600 lines. Numerous observed intersystem combinations connect the terms of different multiplicity. It is noteworthy that Kiess has found 14 of the 16 terms expected from the $4d^5$ configuration.

REFERENCES

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Mo II

Config.	Desig.	J	Level	Interval	Obs. g
$4d^5$	$a\ {}^6S$	2½	0.00		
$4d^4(a\ {}^5D)5s$	$a\ {}^6D$	0½	11783.36	250.70	3.301
		1½	12034.06	383.22	1.847
		2½	12417.28	483.05	1.635
		3½	12900.33	560.37	1.584
		4½	13460.70		1.543
$4d^5$	$a\ {}^4G$	2½	15199.25	131.31	
		3½	15330.56	97.17	
		4½	15427.73	19.24	
		5½	15446.97		
$4d^5$	$a\ {}^4P$	2½	15691.22	−7.94	1.595
		1½	15699.16	−190.96	
		0½	15890.12		
$4d^5$	$a\ {}^4D$	0½	16796.14	377.96	0.758
		1½	17174.10	170.00	1.391
		2½	17344.10	−397.32	1.433
		3½	16946.78		1.404
$4d^5$	$a\ {}^2D$	2½	22444.36	−420.00	1.082
		1½	22864.36		0.688
$4d^5$	$a\ {}^2I$	5½	22980.48	267.71	
		6½	23248.19		
$4d^5$	$a\ {}^4F$	4½	23832.86	−20.49	1.300
		3½	23853.35	−81.01	1.219
		2½	23934.36	−203.29	1.018
		1½	24137.65		0.514
$4d^4(a\ {}^5D)5s$	$b\ {}^4D$	0½	24372.12	287.08	0.058
		1½	24659.20	453.07	1.194
		2½	25112.27	229.31	1.269
		3½	25341.58		1.387
$4d^5$	$a\ {}^2F$	3½	24509.30	−326.79	1.130
		2½	24836.09		1.054
$4d^4(a\ {}^3H)5s$	$a\ {}^4H$	3½	26041.18	446.97	0.798
		4½	26488.15	251.32	0.984
		5½	26739.47	374.36	1.130
		6½	27113.83		1.198
$4d^5$	$a\ {}^2G$	4½	26068.60	−337.01	1.065
		3½	26405.61		0.785
$4d^4(a\ {}^3P)5s$	$b\ {}^4P$	0½	26603.55	1024.00	2.530
		1½	27627.55	1394.57	1.700
		2½	29022.12		1.574
$4d^5$	$b\ {}^2F$	3½	27410.30	−468.59	1.148
		2½	27878.89		0.900
$4d^5$	$a\ {}^2H$	5½	27627.00	−97.69	1.086
		4½	27724.69		0.987
$4d^4(a\ {}^3F)5s$	$b\ {}^4F$	1½	28883.69	−6.87	0.529
		2½	28876.82	112.14	1.035
		3½	28988.96	45.21	1.135
		4½	29034.17		1.278
$4d^5$	$a\ {}^2S$	0½	28950.36		1.908

Mo II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$4d^4(a\,^3G)5s$	$b\,^4G$	2½	29690. 32	320. 04	0. 758
		3½	30010. 36	194. 10	1. 059
		4½	30213. 46	177. 82	1. 192
		5½	30391. 28		1. 268
$4d^4(a\,^3P)5s$	$a\,^2P$	0½	32124. 04	2295. 22	0. 672
		1½	34419. 26		1. 175
$4d^5$	$b\,^2D$	2½	32879. 55	−206. 73	1. 213
		1½	33086. 28		0. 889
$4d^4(a\,^3H)5s$	$b\,^2H$	4½	33045. 37	555. 70	0. 983
		5½	33601. 07		1. 057
$4d^4(a\,^1G)5s$	$b\,^2G$	3½	33146. 30	108. 16	0. 904
		4½	33254. 46		1. 043
$4d^4(a\,^3D)5s$	$c\,^4D$	3½	33549. 28	−320. 44	1. 406
		2½	33869. 72	344. 56	1. 323
		1½	33525. 16	−369. 90	1. 230
		0½	33895. 06		0. 021
$4d^4(a\,^1I)5s$	$b\,^2I$	6½	35099. 46	−306. 56	1. 053
		5½	35406. 02		
$4d^4(a\,^3F)5s$	$c\,^2F$	2½	36288. 80	452. 50	0. 913
		3½	36741. 30		1. 065
$4d^4(a\,^3G)5s$	$c\,^2G$	3½	37431. 45	622. 43	0. 927
		4½	38053. 88		1. 105
$4d^4(a\,^1D)5s$	$c\,^2D$	1½	39243. 45	669. 50	0. 800
		2½	39912. 95		1. 203
$4d^4(a\,^3D)5s$	$d\,^2D$	2½	41421. 34	−120. 66	
		1½	41542. 00		0. 761
$4d^4(a\,^1S)5s$	$b\,^2S$	0½	41873. 66		1. 993
$4d^5$	$d\,^2G$	3½	42169. 30	137. 32	
		4½	42306. 62		
$4d^4(a\,^1F)5s$	$d\,^2F$	2½	42925. 34	66. 84	
		3½	42992. 18		1. 085
$4d^4(b\,^3F)5s$	$e\,^4F$	1½			
		2½			
		3½			
		4½	44212. 16		
$4d^4(a\,^5D)5p$	$z\,^6F^\circ$	0½	45853. 08	295. 04	−0. 650
		1½	46148. 12	466. 02	1. 072
		2½	46614. 14	617. 84	1. 305
		3½	47231. 98	767. 49	1. 375
		4½	47999. 47	960. 21	1. 415
		5½	48959. 68		
$4d^4(a\,^5D)5p$	$z\,^6P^\circ$	0½	47208. 36	814. 09	2. 779
		1½	48022. 45	838. 12	1. 818
		2½	48860. 57		1. 742
$4d^4(a\,^5D)5p$	$z\,^6P^\circ$	1½	49040. 82	567. 92	2. 305
		2½	49608. 74	−127. 70	1. 718
		3½	49481. 04		1. 672
$4d^4(a\,^5D)5p$	$z\,^6D^\circ$	0½	49949. 45	242. 55	3. 155
		1½	50192. 00	385. 36	1. 802
		2½	50577. 36	−274. 82	1. 597
		3½	50302. 54	402. 98	1. 552
		4½	50705. 52		1. 502
$4d^4(a\,^5D)5p$	$z\,^4F^\circ$	1½	51372. 90	359. 49	0. 412
		2½	51732. 39	484. 91	1. 045
		3½	52217. 30	625. 80	1. 262
		4½	52843. 10		1. 362
$4d^4(a\,^5D)5p$	$z\,^4D^\circ$	0½	54238. 80	448. 81	0. 042
		1½	54687. 61	528. 24	1. 197
		2½	55215. 85	490. 72	1. 376
		3½	55706. 57		1. 413

Mo II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$4d^4(a\,^3P)5p$	$y\,^4D^\circ$	0½	57319. 55	821. 20	0. 200
		1½	58140. 75	1207. 19	1. 183
		2½	59347. 94	1354. 22	1. 263
		3½	60702. 16		1. 305
$4d^4(a\,^3H)5p$	$z\,^4H^\circ$	3½	57892. 06	304. 62	0. 710
		4½	58196. 68	564. 27	0. 960
		5½	58760. 95	730. 88	1. 110
		6½	59491. 83		1. 206
$4d^4(a\,^3P)5p$	$z\,^2S^\circ$	0½	58527. 00		1. 651
$4d^4(a\,^3F)5p$	$z\,^4G^\circ$	2½	59053. 32	425. 02	0. 672
		3½	59478. 34	748. 66	0. 923
		4½	60227. 00	889. 18	0. 884
		5½	61116. 18		1. 210
$4d^4(a\,^3H)5p$	$z\,^4I^\circ$	4½	59679. 75	1244. 78	1. 027
		5½	60924. 53	723. 23	0. 936
		6½	61647. 76	503. 90	1. 103
		7½	62151. 66		
$4d^4(a\,^3F)5p$	$z\,^2D^\circ$	1½	59840. 70	1151. 77	0. 862
		2½	60992. 47		1. 205
$4d^4(a\,^3H)5p$	$z\,^2G^\circ$	3½	60135. 37	837. 77	1. 011
		4½	60973. 14		1. 101
$4d^4(a\,^3P)5p$	$y\,^4P^\circ$	0½	61134. 25	322. 52	2. 299
		1½	61456. 77	968. 70	1. 656
		2½	62425. 47		1. 185
$4d^4(a\,^3P)5p$	$z\,^2P^\circ$	1½	61746. 58	−349. 47	1. 220
		0½	62096. 05		1. 075
$4d^4(a\,^3F)5p$	$x\,^4D^\circ$	3½	62491. 78	149. 51	1. 252
		2½	62342. 27	−208. 77	1. 067
		1½	62551. 04	−386. 41	0. 707
		0½	62937. 45		0. 030
	1°	2½	62594. 53		1. 14
$4d^4(a\,^3H)5p$	$z\,^2I^\circ$	5½	62728. 35	251. 89	0. 902
		6½	62980. 24		1. 091
$4d^4(a\,^3F)5p$	$y\,^4F^\circ$	1½	63002. 58	389. 94	0. 899
		2½	63392. 52	−287. 89	1. 002
		3½	63104. 63	678. 47	1. 060
		4½	63783. 10		
	2°	3½	63012. 24		1. 186
$4d^4(a\,^3H)5p$	$y\,^4G^\circ$	2½	63041. 47	−123. 53	0. 851
		3½	62917. 94	35. 81	1. 004
		4½	62953. 75	253. 68	1. 214
		5½	63207. 43		1. 272
$4d^4(a\,^3G)5p$	$y\,^4H^\circ$	3½	63298. 23	199. 31	0. 933
		4½	63497. 54	642. 44	1. 024
		5½	64139. 98	974. 85	1. 166
		6½	65114. 83		
$4d^4(a\,^3G)5p$	$z\,^2F^\circ$	3½	63876. 68	−517. 96	1. 105
		2½	64394. 64		0. 802
$4d^4(a\,^3G)5p$	$x\,^4F^\circ$	1½	63903. 90	263. 94	0. 535
		2½	64167. 84	35. 25	1. 012
		3½	64203. 09	123. 31	1. 208
		4½	64326. 40		1. 258
$4d^4(a\,^3H)5p$	$z\,^2H^\circ$	4½	64130. 22	944. 49	0. 934
		5½	65074. 71		1. 112
$4d^4(a\,^3P)5p$	$z\,^4S^\circ$	1½	64750. 66		1. 926
$4d^4(a\,^3F)5p$	$y\,^2G^\circ$	3½	64852. 22	842. 69	1. 040
		4½	65694. 91		1. 105
$4d^4(a\,^3F)5p$	$y\,^2F^\circ$	3½	65260. 95	−11. 82	
		2½	65272. 77		0. 850

Mo II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$4d^4(a\,^3G)5p$	$y\,^2H^\circ$	4½ 5½	65282.58 65424.65	142.07	 1.175
$4d^4(a\,^3P)5p$	$y\,^2D^\circ$	1½ 2½	65444.30 66082.31	638.01	0.769 1.166
$4d^4(a\,^3G)5p$	$x\,^4G^\circ$	2½ 3½ 4½ 5½	65732.23 66087.55 66391.46 66743.72	355.32 303.91 352.26	0.751 1.209
	3°	3½	65831.24		1.070
$4d^4(a\,^3D)5p$	$w\,^4D^\circ$	0½ 1½ 2½ 3½	66373.65 66399.44 66667.98 66716.34	25.79 268.54 48.36	 1.075 1.289 1.436
$4d^4(a\,^1G)5p$	$x\,^2F^\circ$	3½ 2½	67391.42 67658.13	−266.71	1.130
$4d^4(a\,^3D)5p$	$x\,^4P^\circ$	2½ 1½ 0½	67712.92 68441.66 69049.75	−728.74 −608.09	1.426 1.535 2.410
$4d^4(a\,^3G)5p$	$x\,^2G^\circ$	3½ 4½	67760.30 68052.47	292.17	0.921 1.150
$4d^4(a\,^3D)5p$	$w\,^4F^\circ$	1½ 2½ 3½ 4½	67821.60 68015.92 68179.70 68323.50	194.32 163.78 143.80	 1.250
$4d^4(a\,^1I)5p$	$z\,^2K^\circ$	6½ 7½	67888.85 69047.45	1158.60	0.933
$4d^4(a\,^1I)5p$	$y\,^2I^\circ$	5½ 6½	68472.84 68908.60	435.76	
$4d^4(a\,^3D)5p$	$y\,^2P^\circ$	0½ 1½	68645.50 68902.80	257.30	0.768 1.420
$4d^4(a\,^3D)5p$	$w\,^2F^\circ$	2½ 3½	69729.90 70101.55	371.65	0.885 1.075
$4d^4(a\,^1G)5p$	$x\,^2H^\circ$	4½ 5½	70003.84 70670.57	666.73	
$4d^4(a\,^1D)5p$	$x\,^2D^\circ$	2½ 1½	70713.10 70738.00	−24.90	0.946
$4d^4(a\,^1G)5p$	$w\,^2G^\circ$	4½ 3½	71011.20 71193.53	−182.33	
$4d^4(a\,^1I)5p$	$w\,^2H^\circ$	5½ 4½	71546.56 71920.22	−373.66	

Mo II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$4d^4(a\,^1S)5p$	$x\,^2P^\circ$	0½ 1½	71966.30 73218.97	1252.67	0.670 1.083
$4d^4(a\,^3D)5p$	$w\,^2D^\circ$	1½ 2½	72039.00 72829.62	790.62	1.086 1.156
$4d^4(a\,^1D)5p$	$v\,^2F^\circ$	2½ 3½	72484.19 73032.28	548.09	
$4d^4(a\,^1D)5p$	$w\,^2P^\circ$	0½ 1½	73546.75 74050.37	503.62	 1.289
$4d^4(a\,^1F)5p$	$u\,^2F^\circ$	2½ 3½	74146.50 74491.54	345.04	
$4d^4(b\,^3F)5p$	$t\,^2F^\circ$	3½ 2½	74749.55 74926.17	−176.62	
$4d^4(b\,^3F)5p$	$w\,^4G^\circ$	2½ 3½ 4½ 5½	74858.86 75834.37 76584.60 77663.92	975.51 750.23 1079.32	
$4d^4(a\,^1F)5p$	$v\,^2G^\circ$	3½ 4½	 75685.65		 1.140
$4d^4(b\,^3F)5p$	$v\,^4F^\circ$	1½ 2½ 3½ 4½	 75810.62? 76667.03 76637.38	 856.41 −29.65	
$4d^4(b\,^3P)5p$	$v\,^2D^\circ$	1½ 2½	 75819.80		
$4d^4(b\,^3P)5p$	$v\,^4D^\circ$	0½ 1½ 2½ 3½	 76206.57 76325.00	 118.43	
$4d^4(a\,^1F)5p$	$u\,^2D^\circ$	1½ 2½	 80420.55		
$4d^4(b\,^3F)5p$	$u\,^2G^\circ$	3½ 4½	81526.97 82556.90	1029.93	
$4d^4(b\,^1G)5p$	$t\,^2G^\circ$	4½ 3½	83314.88 83874.15	−559.27	
$4d^4(b\,^1G)5p$	$v\,^2H^\circ$	4½ 5½	83964.88 84496.50	531.62	
$4d^4(b\,^1G)5p$	$s\,^2F^\circ$	3½ 2½	86566.24		
Mo III ($^5D_0$)	*Limit*	---	130300		

February 1958.

Mo II Observed Terms*

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6+$	Observed Terms	
$4d^5$	$a\,^6S$ $a\,^4P$ $a\,^4D$ $a\,^4F$ $a\,^4G$ $a\,^2S$ $a\,^2D$ $a\,^2F$ $a\,^2G$ $a\,^2H$ $a\,^2I$ $b\,^2D$ $b\,^2F$ $d\,^2G$	
	ns ($n \geq 5$)	np ($n \geq 5$)
$4d^4(a\,^5D)ns$	$a\,^6D$ $b\,^4D$	$z\,^6P^\circ$ $z\,^6D^\circ$ $z\,^6F^\circ$ $z\,^4P^\circ$ $z\,^4D^\circ$ $z\,^4F^\circ$
$4d^4(a\,^3H)ns$	$a\,^4H$ $b\,^2H$	$y\,^4G^\circ$ $z\,^4H^\circ$ $z\,^4I^\circ$ $z\,^2G^\circ$ $z\,^2H^\circ$ $z\,^2I^\circ$
$4d^4(a\,^3P)ns$	$b\,^4P$ $a\,^2P$	$z\,^4S^\circ$ $y\,^4P^\circ$ $y\,^4D^\circ$ $z\,^2S^\circ$ $z\,^2P^\circ$ $y\,^2D^\circ$
$4d^4(a\,^3F)ns$	$b\,^4F$ $c\,^2F$	$x\,^4D^\circ$ $y\,^4F^\circ$ $z\,^4G^\circ$ $z\,^2D^\circ$ $y\,^2F^\circ$ $y\,^2G^\circ$
$4d^4(a\,^3G)ns$	$b\,^4G$ $c\,^2G$	$x\,^4F^\circ$ $x\,^4G^\circ$ $y\,^4H^\circ$ $z\,^2F^\circ$ $x\,^2G^\circ$ $y\,^2H^\circ$
$4d^4(a\,^1G)ns$	$b\,^2G$	$x\,^2F^\circ$ $w\,^2G^\circ$ $x\,^2H^\circ$
$4d^4(a\,^3D)ns$	$c\,^4D$ $d\,^2D$	$x\,^4P^\circ$ $w\,^4D^\circ$ $w\,^4F^\circ$ $y\,^2P^\circ$ $w\,^2D^\circ$ $w\,^2F^\circ$
$4d^4(a\,^1I)ns$	$b\,^2I$	$w\,^2H^\circ$ $y\,^2I^\circ$ $z\,^2K^\circ$
$4d^4(a\,^1D)ns$	$e\,^2D$	$w\,^2P^\circ$ $x\,^2D^\circ$ $v\,^2F^\circ$
$4d^4(a\,^1S)ns$	$b\,^2S$	$x\,^2P^\circ$
$4d^4(a\,^1F)ns$	$d\,^2F$	$u\,^2D^\circ$ $u\,^2F^\circ$ $v\,^2G^\circ$
$4d^4(b\,^3F)ns$	$c\,^4F$	$v\,^4F^\circ$ $w\,^4G^\circ$ $t\,^2F^\circ$ $u\,^2G^\circ$
$4d^4(b\,^3P)ns$		$v\,^4D^\circ$ $v\,^2D^\circ$
$4d^4(b\,^1G)ns$		$s\,^2F^\circ$ $t\,^2G^\circ$ $v\,^2H^\circ$

*For predicted terms of the Nb I isoelectronic sequence, see Vol. II, Introduction, p. XXVI.

Mo III

(Zr I sequence; 40 electrons) $Z=42$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^4\ {}^5D_0$

$4d^4\ {}^5D_0$ 218800 K I. P. 27.13 volts

The analysis is from Rico, who has classified 37 lines between 2142 A and 2474 A, from observations made at Madrid for the region 2200 A to 3200 A. These have been supplemented by spectrograms taken at Princeton covering the range 670 A and 2200 A.

The ground term has not been found. Combinations from this term are estimated to lie between 1250 A and 1330 A. Rico has classified 4 lines between 1274 A and 1288 A as representing transitions from $4d^4\ {}^5D_4$, which he estimates to be approximately 1500 K above the ground state zero, $4d^4\ {}^5D_0$. He and Catalán have interpolated the limit by comparison of the third spectra from Y to In.

All of the observed energy levels are relative to this estimated value of 1500 K entered in brackets in the table. Further analysis is necessary to establish more accurate values derived from observed combinations from the ground state zero. The observed terms have been found by comparison with similar spectra in the isoelectronic sequence and with neighboring third spectra.

Rao also reports 27 classified lines of Mo III involving the quintet terms from the ${}^4F$ limit in Mo IV. The two papers have only a few term intervals and lines in common, chiefly in the ${}^5F-{}^5G^\circ$ multiplet.

REFERENCES

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F. R. Rico, An. Real Soc. Esp. Fysica Y. Quimica (Madrid) [A] 50, 185 (1954). (T) (C L)

M. A. Catalán y F. R. Rico, An. Real Soc. Esp. Fisica y Quimica (Madrid) [A] 53, 83 (1957). (I P)

Mo III

Config.	Desig.	J	Level	Interval
$4d^4$	$4d^4\ {}^5D$	0		
		1		
		2		
		3		
		4	[1500]	
$4d^3({}^4F)5s$	$5s\ {}^5F$	1	32045.7+x	424.5
		2	32470.2+x	609.1
		3	33079.3+x	772.9
		4	33852.2+x	904.1
		5	34756.3+x	
$4d^3({}^4F)5p$	$5p\ {}^5G^\circ$	2	73480.2+x	871.5
		3	74351.7+x	1091.9
		4	75443.6+x	1296.6
		5	76740.2+x	1576.2
		6	78316.4+x	

Mo III

Config.	Desig.	J	Level	Interval
$4d^3({}^4F)5p$	$5p\ {}^5D^\circ$	0	75063.0?+x	536.2?
		1	75599.2+x	864.8
		2	76464.0+x	1433.4
		3	77897.4+x	1226.8
		4	79124.2+x	
$4d^3({}^4F)5p$	$5p\ {}^5F^\circ$	1	77361.1+x	323.3
		2	77684.4+x	1451.2
		3	79135.6+x	587.1
		4	79722.7+x	247.5
		5	79970.2+x	
--------------	-------	--	----------	
Mo IV (${}^4F_{1\frac{1}{2}}$)	*Limit*	--	218800	

February 1957.

Mo IV

(Y I sequence; 39 electrons) $Z=42$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^3\;{}^4F_{1\frac{1}{2}}$

$4d^3\;{}^4F_{1\frac{1}{2}}$ 374180 K I. P. 46.4 volts

Eliason has classified some 40 lines between 856.00 A and 2140.98 A. He has derived the limit by a linear extrapolation of isoelectronic sequence data. This value in round figures is entered in brackets in the table.

REFERENCE

A. Y. Eliason, Phys. Rev. 43, 745 (1933). (I P) (T) (C L)

Mo IV

Config.	Desig.	J	Level	Interval
$4d^3$	$4d^3\;{}^4F$	$1\frac{1}{2}$	0.0	
		$2\frac{1}{2}$	780.0	780.0
		$3\frac{1}{2}$	1759.0	979.0
		$4\frac{1}{2}$	2858.6	1099.6
$4d^2(^3F)5s$	$5s\;{}^4F$	$1\frac{1}{2}$	60893.4	
		$2\frac{1}{2}$	61624.1	730.7
		$3\frac{1}{2}$	62705.3	1081.2
		$4\frac{1}{2}$	64042.6	1337.3
$4d^2(^3F)5p$	$5p\;{}^4G^\circ$	$2\frac{1}{2}$	*109412.9*	
		$3\frac{1}{2}$	*111336.6*	1923.7
		$4\frac{1}{2}$	*113439.3*	2102.7
		$5\frac{1}{2}$	*115876.4*	2437.1

Mo IV

Config.	Desig.	J	Level	Interval
$4d^2(^3F)5p$	$5p\;{}^4F^\circ$	$1\frac{1}{2}$	*111756.5*	
		$2\frac{1}{2}$	*112921.0*	1164.5
		$3\frac{1}{2}$	*114619.4*	1698.4
		$4\frac{1}{2}$	*115956.7*	1337.3
$4d^2(^3F)5p$	$5p\;{}^4D^\circ$	$0\frac{1}{2}$	*115790.4*	
		$1\frac{1}{2}$	*116584.3*	793.9
		$2\frac{1}{2}$	*117602.3*	1018.0
		$3\frac{1}{2}$	*118076.5*	474.2
Mo V $(^3F_2)$	*Limit*	-------	[374180]	

April 1951.

Mo v

(Sr I sequence; 38 electrons) $Z=42$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^2\;{}^3F_2$

$4d^2\;{}^3F_2$ 493300 K I. P. 61.2 volts

The analysis is by Trawick, who has classified 90 lines between 410.35 A and 2159.30 A. He has extrapolated the limit on a Moseley diagram of isoelectronic sequence data. This value of the limit, rounded off, is entered in brackets in the table.

The singlet and triplet terms are connected by observed intersystem combinations.

REFERENCE

M. W. Trawick, Phys. Rev. 48, 223 (1935). (I P) (T) (C L)

Mo v

Config.	Desig.	J	Level	Interval
$4d^2$	$4d^2\;{}^3F$	2 3 4	0 1585 3359	1585 1774
$4d^2$	$4d^2\;{}^3P$	0 1 2	11165 11812 13413	647 1601
$4d(^2D)5s$	$5s\;{}^1D$	2	83971	
$4d(^2D)5s$	$5s\;{}^3D$	1 2 3	92381 93113 94837	732 1724
$4d(^2D)5p$	$5p\;{}^1F^\circ$	3	*141150*	
$4d(^2D)5p$	$5p\;{}^1P^\circ$	1	*147909*	
$4d(^2D)5p$	$5p\;{}^3D^\circ$	1 2 3	*148950* *151212* *153041*	2262 1829
$4d(^2D)5p$	$5p\;{}^3F^\circ$	2 3 4	*150346* *151196* *155033*	850 3837
$4d(^2D)5p$	$5p\;{}^1D^\circ$	2	*151760*	
$4d(^2D)5p$	$5p\;{}^3P^\circ$	0 1 2	*157060* *156616* *157852*	−444 1236
$4d(^2D)5d$	$5d\;{}^1D$	2	212620	
$4d(^2D)5d$	$5d\;{}^3D$	3 2 1	213840 214671 214786	−831 −115
$4d(^2D)5d$	$5d\;{}^1P$	1	215874	
$4d(^2D)4f$	$4f\;{}^3F^\circ$	2 3 4	*231724* *234886* *241112*	3162 6226
$4d(^2D)5d$	$5d\;{}^3F$	2 3 4	236714 239071 242104	2357 3033
$4d(^2D)4f$	$4f\;{}^3G^\circ$	3 4 5	*243665* *244841* *245830*	1176 989
Mo VI ($^2D_{1\frac{1}{2}}$)	*Limit*	-------	[493300]	

April 1951.

Mo v Observed Terms*

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6+$	Observed Terms								
$4d^2$	$4d^2\;{}^3P$	$4d^2\;{}^3F$							
	$ns\;(n\geq5)$	$np\;(n\geq5)$			$nd\;(n\geq5)$			$nf\;(n\geq4)$	
$4d(^2D)nx$	$5s\;{}^3D$ $5s\;{}^1D$	$5p\;{}^3P^\circ$ $5p\;{}^1P^\circ$	$5p\;{}^3D^\circ$ $5p\;{}^1D^\circ$	$5p\;{}^3F^\circ$ $5p\;{}^1F^\circ$	$5d\;{}^1P$	$5d\;{}^3D$ $5d\;{}^1D$	$5d\;{}^3F$	$4f\;{}^3F^\circ$	$4f\;{}^3G^\circ$

*For predicted terms in the spectra of the Sr I isoelectronic sequence, see Vol. II Introduction, page XXIII.

Mo VI

(Rb I sequence; 37 electrons) Z=42

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d\ ^2D_{1\frac{1}{2}}$

$4d\ ^2D_{1\frac{1}{2}}$ 549000 K I. P. 68 volts

Sixteen lines have been classified as combinations among seven terms. The observations extend from 296 A to 1595 A. Trawick has published six terms and extrapolated a limit from isoelectronic sequence data. From recent series data in Zr IV combined with the series of Mo VI, Kiess has derived an improved value of the limit, which is quoted here.

Charles has recently reobserved the spectrum between 296 A and 790 A and confirmed three of the four terms from Trawick's list, covered by this range. The one exception is $4f\ ^2F^\circ$, which he revises. Trawick lists this term as follows:

Desig.	J	Level	Interval
$4f\ ^2F^\circ$	2½ 3½	*267451* *267855*	404

Charles also resolves the members of his $4d\ ^2D-4f\ ^2F^\circ$ group, and adds tentative values of the $6p\ ^2P^\circ$ term.

The measurements common to the two lists are in satisfactory agreement. In the table the term values from Charles' paper are quoted, but the two terms $5s\ ^2S$ and $5d\ ^2D$ are from Trawick's paper.

REFERENCES

M. W. Trawick, Phys. Rev. 46, 63 (1934). (I P) (T) (C L)
G. W. Charles, Phys. Rev. 77, 120 (1950). (T) (C L)
C. C. Kiess, unpublished material (October 1955). (I P)

Mo VI

Config.	Desig.	J	Level	Interval
$4p^6(^1S)4d$	$4d\ ^2D$	1½ 2½	0 2578	2578
$4p^6(^1S)5s$	$5s\ ^2S$	0½	119739	
$4p^6(^1S)5p$	$5p\ ^2P^\circ$	0½ 1½	*182404* *187329*	4925
$4p^6(^1S)4f$	$4f\ ^2F^\circ$	2½ 3½	*267043* *267451*	408
$4p^6(^1S)5d$	$5d\ ^2D$	1½ 2½	282837 283624	787
$4p^6(^1S)6s$	$6s\ ^2S$	0½	313810	
$4p^6(^1S)6p$	$6p\ ^2P^\circ$	0½? 1½?	*336331* *337739*	1408
Mo VII ($^1S_0$)	*Limit*	-------	[549000]	

October 1955.

Mo VII

(Kr I sequence; 36 electrons) Z=42

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\;{}^1S_0$

$4p^6\;{}^1S_0$ 1020460 K I. P. 126 volts

The analysis is far from complete. Charles has classified 6 lines between 136 A and 286 A as due to transitions from the ground term to levels produced by $4d$, $5d$, $5s$, and $6s$-electrons. The level-values in the table are the rounded-off wave numbers of the observed lines. He has estimated the limit quoted above by applying a Rydberg formula to the $ns\,s_4$ levels (n=5, 6). The higher limit in the table has been determined by the writer by adding the interval of the ground term of Mo VIII to the lower limit.

As for Kr I the writer has introduced the Jl-coupling notation in the general form suggested by Racah. Charles has noted that the $4d$ and $5d$ assignments are open to some question. Consequently the pair-coupling notation for these levels may need revision.

REFERENCES

G. Racah, Phys. Rev. **61**, 537 (L) (1942).
G. W. Charles, Phys. Rev. **77**, 120 (1950). (I P) (T) (C L)

Mo VII

Author	Config.	Desig.	J	Level
$4p^6\,p_0$	$4p^6$	$4p^6\;{}^1S$	0	0
$4d\;d_2$	$4p^5(^2P^\circ_{1\frac{1}{2}})4d$	$4d\;[1\frac{1}{2}]^\circ$	2 1	*349290*
$5s\;s_4$	$4p^5(^2P^\circ_{1\frac{1}{2}})5s$	$5s\;[1\frac{1}{2}]^\circ$	2 1	*481290*
$5s\;s_2$	$4p^5(^2P^\circ_{\frac{1}{2}})5s$	$5s'\;[0\frac{1}{2}]^\circ$	0 1	*502920*
$5d\;d_2$?	$4p^5(^2P^\circ_{1\frac{1}{2}})5d$	$5d\;[1\frac{1}{2}]^\circ$	2 1	*668280*
$6s\;s_4$	$4p^5(^2P^\circ_{1\frac{1}{2}})6s$	$6s\;[1\frac{1}{2}]^\circ$	2 1	*709450*
$6s\;s_2$	$4p^5(^2P^\circ_{\frac{1}{2}})6s$	$6s'\;[0\frac{1}{2}]^\circ$	0 1	*731660*
	Mo VIII $(^2P^\circ_{1\frac{1}{2}})$	*Limit*	....	1020460
	Mo VIII $(^2P^\circ_{\frac{1}{2}})$	*Limit*	....	1043740

February 1951.

Mo VIII

(Br I sequence; 35 electrons) Z=42

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^5\;{}^2P^\circ_{1\frac{1}{2}}$

$4p^5\;{}^2P^\circ_{1\frac{1}{2}}$ *1235000* K I. P. 153 volts

The analysis is incomplete. Charles has classified 42 lines between 168 A and 474 A as due to transitions from the ground term to 14 higher terms.

He has extrapolated the value of the limit from isoelectronic sequence data.

REFERENCE

G. W. Charles, Phys. Rev. **77**, 120 (1950). (I P) (T) (C L)

Mo VIII

Config.	Desig.	J	Level	Interval
$4s^2\,4p^5$	$4p^5\ ^2P^\circ$	1½	*0*	−23277
		0½	*23277*	
$4s\,4p^6$	$4p^6\ ^2S$	0½	233830	
$4s^2\,4p^4(^3P)4d$	$4d\ ^4D$	3½		
		2½	301557	−8862
		1½	310419	−9037
		0½?	319456	
$4s^2\,4p^4(^3P)4d$	$4d\ ^4P$	0½	363255	8090
		1½	371345	6543
		2½	377888	
$4s^2\,4p^4(^3P)4d$	$4d\ ^4F$	4½		
		3½		
		2½	367822	−145
		1½	367967	
$4s^2\,4p^4(^3P)4d$	$4d\ ^2D$	1½	376122	15057
		2½	391179	
$4s^2\,4p^4(^3P)4d$	$4d\ ^2P$	0½		
		1½?	381102	
$4s^2\,4p^4(^3P)4d$	$4d\ ^2F$	3½		
		2½	409395	
$4s^2\,4p^4(^1D)4d$	$4d'\ ^2D$	2½	423722	−20518
		1½	444240	
$4s^2\,4p^4(^1D)4d$	$4d'\ ^2P$	1½	445430	
		0½		
$4s^2\,4p^4(^1S)4d$	$4d''\ ^2D$	2½?	447888	−6419
		1½?	454307	
$4s^2\,4p^4(^3P)5s$	$5s\ ^4P$	2½		
		1½?	492522	−10787
		0½	503309	
$4s^2\,4p^4(^3P)5s$	$5s\ ^2P$	1½	527428	−15924
		0½	543352	
$4s^2\,4p^4(^1D)5s$	$5s'\ ^2D$	2½	536550	−12366
		1½	548916	
$4s^2\,4p^4(^1S)5s$	$5s''\ ^2S$	0½	595062	
Mo IX ($^3P_2$)	*Limit*	-------	[*1235000*]	

February 1951.

Mo VIII Observed Terms*

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}+$	Observed Terms	
$4s^2\,4p^5$	$4p^5\ ^2P^\circ$	
$4s\,4p^6$	$4p^6\ ^2S$	
	$ns\ (n \geq 5)$	$nd\ (n \geq 4)$
$4s^2\,4p^4(^3P)nx$	$5s\ ^4P$ $5s\ ^2P$	$4d\ ^4P$ $4d\ ^4D$ $4d\ ^4F$ $4d\ ^2P$ $4d\ ^2D$ $4d\ ^2F$
$4s^2\,4p^4(^1D)nx'$	$5s'\ ^2D$	$4d'\ ^2P$ $4d'\ ^2D$
$4s^2\,4p^4(^1S)nx''$	$5s''\ ^2S$	$4d''\ ^2D$

*For predicted terms in the spectra of the Br I isoelectronic sequence, see Vol. II, Introduction, page XXI.

Mo XVI

(Co I sequence; 27 electrons) $Z=42$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^9\ ^2D_{2\frac{1}{2}}$

$3d^9\ ^2D_{2\frac{1}{2}}$ K I. P. volts

This spectrum has not been analyzed, but Edlén has observed three lines due to the transition $3p^6\,3d^9\ ^2D-3p^5\,3d^{10}\ ^2P^\circ$. In figure 4 of his paper on the spectra of highly-ionized atoms, the observed wave numbers are plotted against atomic number for this combination in the Co I-like spectra Rb XI to Mo XVI. For Mo XVI the wave numbers are between 1300000 and 1500000 K.

REFERENCE

B. Edlén, Physica 13, No. 9, 548 (1947).

February 1950.

TECHNETIUM

Tc I

43 electrons $Z=43$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^5\ 5s^2\ {}^6S_{2\frac{1}{2}}$

$a\ {}^6S_{2\frac{1}{2}}$ 58700 K I. P. 7.28 volts

A description of the spectrum was published by Meggers and Scribner in 1950. The next year Meggers reported the first regularities: 20 terms, 200 classified lines, and an approximate ionization potential.

The spectrum has since been reobserved by Bozman, Corliss, and Meggers. The present line list covers the range 2057.70 A to 8917.74 A. The analysis has been extended by Bozman especially for inclusion here. His work is still in progress; the tabular data represent only the results available when the present Volume was concluded for press. The observed g-values are, also, from Zeeman spectrograms taken at the National Bureau of Standards.

There are approximately 900 classified lines. Observed intersystem combinations connect the systems of terms of different multiplicity.

Bozman has revised the earlier value of the limit. The present limit is from the $4d^5(a\ {}^5D)ns\ {}^{6,4}D$ series ($n=5,6$). It has been derived by a Rydberg formula, with a Ritz correction $\alpha=2.0\times10^{-6}$, described in the 1951 paper. It agrees well with the value interpolated by Catalán from neighboring spectra, 58297 K.

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W. F. Meggers and B. F. Scribner, J. Research Nat. Bur. Std. **45**, 476, RP 2161 (1950).

W. F. Meggers, J. Research Nat. Bur. Std. **47**, 7, RP 2221 (1951). (I P) (T) (C L)

M. A. Catalán y F. R. Rico, An. Real Soc. Esp. Física y Química (Madrid) [A] **48**, 328 (1952). (I P)

K. G. Kessler and R. E. Trees, Phys. Rev. (2) **92**, 303 (1953). (hfs)

H. E. Walchli, *A Table of Nuclear Moment Data*, Oak Ridge Nat. Lab., ORNL-1469, Suppl. II, 29 (1955). (Summary hfs)

W. R. Bozman, unpublished material (June 1957). (I P) (T) (C L) (Z E)

Tc I

Config.	Desig.	J	Level	Interval	Obs. g
$4d^5\,5s^2$	$a\,^6S$	2½	0.00		1.99
$4d^6(a\,^5D)5s$	$a\,^6D$	4½	2572.89	−678.02	1.60
		3½	3250.91	−449.64	1.59
		2½	3700.55	−302.03	1.65
		1½	4002.58	−176.14	1.86
		0½	4178.72		3.32
$4d^6(a\,^5D)5s$	$a\,^4D$	3½	10516.54	−546.54	1.44
		2½	11063.08	−515.51	1.37
		1½	11578.59	−312.37	1.21
		0½	11890.96		0.02
$4d^6(^3P)5s$	$a\,^4P$	2½	13252.73	−917.02	1.62
		1½	14169.75	−510.17	1.70
		0½	14679.92		2.63
$4d^6(^3F)5s$	$a\,^4F$	4½	14733.14	−565.33	1.31
		3½	15298.47	−325.79	1.20
		2½	15624.26	−146.16	1.02
		1½	15770.42		0.42
$4d^6(^3G)5s$	$a\,^4G$	5½	16025.16	−108.83	1.23
		4½	16133.99	−153.81	1.17
		3½	16287.80	−127.84	0.95
		2½	16415.64		0.58
$4d^5\,5s(a\,^7S)5p$	$z\,^8P^\circ$	2½	*16428.71*	445.80	2.30
		3½	*16874.51*	648.44	1.94
		4½	*17522.95*		1.80
$4d^5\,5s(a\,^7S)5p$	$z\,^6P^\circ$	3½	*23265.33*	−189.88	1.70
		2½	*23455.21*	−133.19	1.90
		1½	*23588.40*		2.42
$4d^6(a\,^5D)5p$	$z\,^6D^\circ$	4½	*27369.78*	−290.31	1.53
		3½	*27660.09*	−280.63	1.57
		2½	*27940.72*	−210.56	1.64
		1½	*28151.28*	−145.41	1.85
		0½	*28296.69*		3.30
$4d^6(a\,^5D)5p$	$z\,^6F^\circ$	5½	*30067.29*	−65.96	1.50
		4½	*30133.25*	−248.81	1.41
		3½	*30382.06*	−146.79	1.38
		2½	*30528.85*	−101.78	1.29
		1½	*30630.63*	−58.49	1.07
		0½	*30689.12*		−0.62
$4d^6(a\,^5D)5p$	$z\,^4F^\circ$	4½	*31114.09*	−490.90	1.37
		3½	*31604.99*	−409.80	1.32
		2½	*32014.79*	−238.86	1.14
		1½	*32253.65*		0.85

Tc I

Config.	Desig.	J	Level	Interval	Obs. g
$4d^6(a\,^5D)5p$	$y\,^6P^\circ$	3½	*31414.07*	7.31	1.72
		2½	*31406.76*	−97.20	1.80
		1½	*31503.96*		2.26
$4d^6(a\,^5D)5p$	$z\,^4P^\circ$	2½	*31927.01*	−331.06	1.59
		1½	*32258.07*	−145.00	1.40
		0½	*32403.07*		2.65
$4d^6(a\,^5D)5p$	$z\,^4D^\circ$	3½	*32620.37*	−465.33	1.39
		2½	*33085.70*	−257.47	1.39
		1½	*33343.17*	−137.30	1.20
		0½	*33480.47*		0.02
$4d^5\,5s(a\,^5S)5p$	$y\,^4P^\circ$	2½	*34515.90*	−426.76	1.61
		1½	*34942.66*	−333.79	1.74
		0½	*35276.45*		2.66
$4d^5\,5s(a\,^7S)6s$	$e\,^8S$	3½	37612.40		2.02
$4d^5\,5s(a\,^5S)5p$	$x\,^6P^\circ$	3½	*38240.77*	24.02	1.66
		2½	*38216.75*	−102.85	1.89
		1½	*38319.60*		2.35
$4d^5\,5s(a\,^7S)6s$	$e\,^6S$	2½	39598.85		2.00
$4d^6(a\,^5D)6s$	$e\,^6D$	4½	42855.22	−536.53	1.56
		3½	43391.75	−404.96	1.57
		2½	43796.71	−232.21	1.65
		1½	44028.92	−120.59	1.87
		0½	44149.51		3.30
$4d^6(a\,^5D)6s$	$e\,^4D$	3½	44102.00	−702.36	
		2½	44804.36	−463.48	
		1½	45267.84	−229.92	
		0½	45497.76		
$4d^5\,5s(a\,^7S)5d$	$e\,^8D$	1½	44333.23	4.30	
		2½	44337.53	6.39	2.08
		3½	44343.92	8.74	1.84
		4½	44352.66	12.67	1.67
		5½	44365.33		1.66
$4d^5\,5s(a\,^7S)5d$	$f\,^6D$	4½	44919.07	−66.46	1.54
		3½	44985.53	−85.49	1.58
		2½	45071.02	−37.60	1.66
		1½	45108.62	−81.08	1.87
		0½	45189.70		3.32
Tc II ($^7S_3$)	*Limit*	-----	58700		

June 1957.

Tc II

(Mo I sequence; 42 electrons) $Z=43$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^5\,5s\ {}^7S_3$

$a\ {}^7S_3$ 123100 K I. P. 15.26 volts

Meggers and Scribner first observed this spectrum in 1950, and Meggers reported the first regularities in 1951. He classified the 10 leading lines arising from the low ^7S and ^5S terms, and stressed the similarity between the spectra of Mn II and Tc II. In 1952, he and Catalán identified the important low ^5D term from the $3d^6$ configuration, with its leading component 3461 K above the ground term $a\ {}^7S$.

A new description of the spectrum has since been made by Bozman, Corliss, and Meggers, which covers the range 2054.468 A to 6673.263 A. From these observations the writer has carried the analysis somewhat further with the aid of Bureau Zeeman data from Bozman. Unfortunately, the new terms are not connected with the earlier ones because observations are lacking in the region short of 2054 A. The writer has arbitrarily adopted 24000 K for $a\ {}^5G_6$, with the correction, x, to be determined later when the line list has been extended. Trees has predicted the theoretical position of this ^5G term at 22500±1000 K.

There are about 50 classified lines, but the analysis is seriously incomplete. Intersystem combinations connect the terms in the table that need no correction, x.

No series are known, but Catalán and Rico have interpolated the limit quoted here, by comparison with neighboring second spectra in the second long period.

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C. E. Moore, unpublished material (June 1957). (T) (C L)

Tc II

Config.	Desig.	J	Level	Interval	Obs. g
$4d^5(^6S)5s$	$a\ {}^7S$	3	0.00		2.02
$4d^6$	$a\ {}^5D$	4	3461.27	−755.90	1.47
		3	4217.17	−452.05	1.50
		2	4669.22	−291.92	1.52
		1	4961.14	−139.84	1.56
		0	5100.98		0/0
$4d^5(^6S)5s$	$a\ {}^5S$	2	12617.20		2.04
$4d^5(^4G)5s$	$a\ {}^5G$	2	23838.39+x	78.78	0.37
		3	23917.17+x	61.48	0.89
		4	23978.65+x	46.23	1.15
		5	24024.88+x	−24.88	1.30
		6	24000.00+x		1.32
$4d^5(^6S)5p$	$z\ {}^7P^\circ$	2	*37767.21*	535.59	2.36
		3	*38302.80*	1005.58	1.88
		4	*39308.38*		1.78
$4d^5(^6S)5p$	$z\ {}^5P^\circ$	3	*43500.96*	−240.37	1.65
		2	*43741.33*	−163.67	1.86
		1	*43905.00*		2.50
$4d^5(^4G)5p$	$z\ {}^5G^\circ$	2	*59034.69+x*	193.06	0.42
		3	*59227.75+x*	184.45	0.90
		4	*59412.20+x*	168.98	1.16
		5	*59581.18+x*	176.47	1.26
		6	*59757.65+x*		1.36
$4d^5(^4G)5p$	$z\ {}^5H^\circ$	3	*60535.64+x*	59.14	0.54
		4	*60594.78+x*	648.74	0.97
		5	*61243.52+x*	472.53	
		6	*61716.05+x*	224.61	1.24
		7	*61940.66+x*		1.31
$4d^5(^4G)5p$	$z\ {}^5F^\circ$	1	*60707.68+x*	321.56	0.04
		2	*61029.24+x*	318.44	
		3	*61347.68+x*	71.47	1.15
		4	*61419.15+x*	383.93	1.34
		5	*61803.08+x*		1.41
Tc III ($^6S_{2½}$)	*Limit*	-----	123100		

June 1957.

RUTHENIUM

Ru I

44 electrons $Z=44$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^7\ 5s\ {}^5F_5$

$a\ {}^6F_5$ 59410 K I. P. 7.364 volts

The first significant regularities in the Ru I spectrum were reported in 1925 by Meggers and Laporte and by Sommer. In 1926 relative term values confirmed by observed g-values were published by these authors. Harrison and McNally derived improved g-values from Zeeman observations made at the Massachusetts Institute of Technology, and extended the analysis in 1940. Later, McNally carried this work further. His unpublished 1941 manuscript includes 61 even and 188 odd levels, and has been made available to the National Bureau of Standards for further study of Ru I.

Kessler and Meggers reobserved the spectrum, and in 1955 published a complete new description which Kessler has used to extend the analysis. His manuscript has been furnished in advance of publication, and used for the data in the table. He has adjusted all level values to fit the 1955 observations. Most of the observed g-values in the table are from the 1940 and 1941 work of Harrison and McNally. A few additional ones are from Zeeman spectrograms taken in 1949 by Meggers with the Bitter magnet at the Massachusetts Institute of Technology, and measured by Kessler.

At present 100 even and 205 odd levels are known, and there are approximately 3250 classified lines between 2013.95 A and 11483.91 A. Many observed intersystem combinations connect the systems of terms of different multiplicity.

The more dubious configuration assignments are indicated by a colon in the first column of the table. Members of fragmentary terms have a designation entered in parentheses in column two, along with a number labeling the level as miscellaneous. Extensive theoretical study of Ru I by Trees confirms in detail the observed values of the low even terms, and has been an invaluable guide in making a number of the configuration assignments for additional terms.

The limit quoted above has been derived by Kessler from the two-member series $4d^7(a\ {}^4F)ns\ {}^5F_5$ $(n=5,6)$, by means of a Rydberg formula, corrected by the factor $\alpha=-2.43\times10^{-6}$ suggested by Catalán and Rico. They have obtained this Ritz correction from a study of the series in the first spectra from Rb I through Ag I. The observed limit thus corrected agrees excellently with the interpolated value 59417 obtained by Catalán and Rico.

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Ru I

Config.	Desig.	J	Level	Interval	Obs. g
$4d^7(a\,^4F)5s$	$a\ ^5F$	5	0.00	−1190.64	1.397
		4	1190.64	−900.90	1.349
		3	2091.54	−621.70	1.249
		2	2713.24	−392.25	1.000
		1	3105.49		0.000
$4d^7(a\,^4F)5s$	$a\ ^3F$	4	6545.03	−1539.09	1.284
		3	8084.12	−1099.54	1.196
		2	9183.66		1.089
$4d^6\,5s^2$	$a\ ^5D$	4	7483.07	−1092.35	1.447
		3	8575.42	−482.22	1.420
		2	9057.64	−15.34	1.232
		1	9072.98	−410.39	1.795
		0	9492.37		0/0
$4d^7(a\,^4P)5s$	$a\ ^5P$	3	8770.93	727.24	1.624
		2	8043.69	−1576.60	1.536
		1	9620.29		1.985
$4d^8$	$b\ ^3F$	4	9120.63	−1533.99	1.255
		3	10654.62	−792.69	1.086
		2	11447.31		0.764
$4d^7(a\,^2P)5s$	$a\ ^3P$	2	10623.53	−1162.52	1.534
		1	11786.05	33.43	1.684
		0	11752.62		0/0
$4d^7(a\,^2G)5s$	$a\ ^3G$	5	12207.05	−609.64	1.190
		4	12816.69	−882.38	1.033
		3	13699.07		0.757
$4d^7(a\,^4P)5s$	$b\ ^3P$	2	13645.75	−335.92	1.315
		1	13981.67	−845.83	1.441
		0	14827.50		0/0
$4d^7(a\,^2G)5s$	$a\ ^1G$	4	14700.32		0.992
$4d^7(a\,^2D)5s$	$a\ ^3D$	3	16190.61	1136.54	1.333
		2	15054.07	−1658.51	1.162
		1	16712.58		0.676
$4d^7(a\,^2H)5s$	$a\ ^3H$	6	15550.16	−689.97	1.164
		5	16240.13	−856.74	1.041
		4	17096.87		0.834
$4d^7(a\,^2D)5s$	$a\ ^1D$	2	17045.97		1.175
$4d^7(a\,^2H)5s$	$a\ ^1H$	5	20055.71		1.007
$4d^7(a\,^2P)5s$	$a\ ^1P$	1	20242.01		0.927
$4d^8$	$c\ ^3P$	2	20933.75	−1358.89	1.343
		1	22292.64	−1881.04?	1.35
		0	24173.68?		
$4d^6\,5s^2$	$c\ ^3F$	4	21643.09	−776.37	1.08
		3	22419.46	76.32	1.070
		2	22343.14		0.697
$4d^6\,5s^2$	$b\ ^3H$	6	22162.06	−356.82	1.063
		5	22518.88	−485.89	0.99
		4	23004.77		0.91?
$4d^8$	$b\ ^1G$	4	23392.60		0.950
$4d^8$	$b\ ^1D$	2	23453.47		1.162
$4d^6\,5s^2$	$d\ ^3P$?	2	24927.48	−2633.11	
		1	27560.59		
		0			
$4d^6\,5s(a\,^6D)5p$	$z\ ^7D^\circ$	5	*25214.16*	−250.33	1.592
		4	*25464.49*	−571.07	1.625
		3	*26035.56*	−437.18	1.737
		2	*26472.74*	−307.72	1.992
		1	*26780.46*		
$4d^6\,5s^2$	$b\ ^3G$	5	25602.60	−40.09	
		4	25642.69	−433.01	
		3	26075.70		

Ru I

Config.	Desig.	J	Level	Interval	Obs. g
$4d^7(a\,^4F)5p$	$z\ ^5D^\circ$	4	*26312.83*	−1193.76	1.486
		3	*27506.59*	−959.10	1.425
		2	*28465.69*	−652.80	1.324
		1	*29118.49*	−451.41	0.953
		0	*29569.90*		0/0
$4d^7(a\,^4F)5p$	$z\ ^5F^\circ$	5	*26816.23*	−1198.56	1.394
		4	*28014.79*	−875.68	1.364
		3	*28890.47*	−536.85	1.293
		2	*29427.32*	−266.25	1.164
		1	*29693.57*		0.567
$4d^7(a\,^2F)5s$:	$d\ ^3F$	4	27289.24	−227.33	
		3	27516.57		
		2			
$4d^7(a\,^4F)5p$	$z\ ^3G^\circ$	5	*28495.10*	−1395.81	1.230
		4	*29890.91*	−1961.99	
		3	*31852.90*		0.868
$4d^7(a\,^4F)5p$	$z\ ^5G^\circ$	6	*28571.89*	−1707.79	1.379
		5	*30279.68*	−1066.11	1.263
		4	*31345.79*	808.73	1.111
		3	*30537.06*	−421.74	0.944
		2	*30958.80*		0.375
$4d^6\,5s(a\,^6D)5p$	$z\ ^7F^\circ$	6	*29160.46*	−307.58	1.462
		5	*29468.04*	−126.52	1.474
		4	*29594.56*	−297.34	1.370
		3	*29891.90*	−126.44	
		2	*30018.34*	−67.04	1.497
		1	*30085.38*	−29.87	
		0	*30115.25*		0/0
$4d^6\,5s^2$	$b\ ^3D$	1			
		2	29352.41	626.59	
		3	29979.00		
$4d^6\,5s(a\,^6D)5p$	$z\ ^7P^\circ$	4	*30250.40*	−1134.24	1.656
		3	*31384.64*	−958.66	1.895
		2	*32343.30*		2.059
$4d^7(a\,^4F)5p$	$z\ ^3F^\circ$	4	*30348.45*	−2043.50	1.276
		3	*32391.95*	−780.07	1.133
		2	*33172.02*		1.026
$4d^7(a\,^4F)5p$	$z\ ^3D^\circ$	3	*31044.35*	−1163.30	1.204
		2	*32207.65*	−1372.57	1.032
		1	*33580.22*		0.522
$4d^7(a\,^4P)5p$	$z\ ^5S^\circ$	2	*31186.03*		2.034
$4d^6\,5s(a\,^6D)5p$	$y\ ^5D^\circ$	4	*33446.84*	16.19	1.492
		3	*33430.65*	−298.01	1.496
		2	*33728.66*	−362.40	1.477
		1	*34091.06*	−288.58	1.522
		0	*34379.64*		0/0
$4d^6\,5s(a\,^6D)5p$	$z\ ^5P^\circ$	3	*34072.41*	−809.51	1.646
		2	*34881.92*	−164.85	1.808
		1	*35046.77*		2.385
$4d^6\,5s(a\,^6D)5p$	$y\ ^5F^\circ$	5	*34772.55*	−698.60	1.402
		4	*35471.15*	−335.47	1.364
		3	*35806.62*	−157.25	1.276
		2	*35963.87*	−274.90	1.069
		1	*36238.77*		0.145
$4d^7(a\,^4P)5p$	$x\ ^5D^\circ$	4	*36542.62*	−824.40	1.481
		3	*37367.02*	−300.84	1.379
		2	*37667.86*	−532.54	1.442
		1	*38200.40*	398.17	1.569
		0	*37802.23*		0/0
$4d^7(a\,^4P)5p$	$y\ ^3D^\circ$	3	*36760.34*	−204.94	1.426
		2	*36965.28*	−654.24	1.173
		1	*37619.52*		0.756
$4d^7(a\,^4P)5p$	$z\ ^3P^\circ$	2	*37118.90*	−227.84	1.469
		1	*37346.74*	−126.14	1.311
		0	*37472.88*		0/0

Ru I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$4d^7(a\ ^2G)5p$	$y\ ^3F^\circ$	4 3 2	*38243.38* *39433.70* *40433.23*	−1190.32 −999.53	1.107 0.968 0.889
$4d^7(a\ ^2G)5p$	$z\ ^3H^\circ$	6 5 4	*38897.50* *38297.09* *39273.28*	600.41 −976.19	1.174 1.048 0.895
$4d^7(a\ ^4P)5p$	$z\ ^5S^\circ$	1	*38587.14*		1.566
$4d^7(a\ ^4P)5p$	$y\ ^5P^\circ$	3 2 1	*38706.36* *39008.62* *39773.49*	−302.26 −764.87	1.631 1.713 2.315
$4d^7(a\ ^2G)5p$	$z\ ^1G^\circ$	4	*39037.18*		1.115
$4d^7(a\ ^2G)5p$	$y\ ^3G^\circ$	5 4 3	*39450.66* *40276.61* *40235.39*	−825.95 41.22	1.142 1.035 0.890
$4d^7(a\ ^2P)5p$	$y\ ^3P^\circ$	2 1 0	*39742.03* *39916.54* *39894.50*	−174.51 22.04	1.299 1.606 0/0
	$1^\circ(^3F^\circ)$	4	*40439.25*		1.196
$4d^7(a\ ^2G)5p$	$z\ ^1H^\circ$	5	*40616.22*		1.020
$4d^7(a\ ^2P)5p$	$x\ ^3D^\circ$	3 2 1	*40768.15* *42007.26* *41016.65*	−1239.11 990.61	1.159 1.007 0.895
$4d^7(a\ ^2G)5p$	$z\ ^1F^\circ$	3	*40948.65*		1.137
$4d^7(a\ ^2D)5p$	$x\ ^3F^\circ$	2 3 4	*41182.94* *41260.04* *42346.90*	77.10 1086.86	0.887 1.235 1.247
$4d^7(a\ ^4F)6s$	$e\ ^5F$	5 4 3 2 1	41256.40 43018.57 44176.23 43892.09 44343.91	−1762.17 −1157.66 284.14 −451.82	
$4d^7(a\ ^2D)5p$	$w\ ^3D^\circ$	3 2 1	*41482.66* *42533.81* *42894.42*	−1051.15 −360.61	1.286 1.025 0.810
$4d^7(a\ ^2H)5p$	$z\ ^3I^\circ$	7 6 5	*42260.53* *41577.75* *42978.28*	682.78 −1400.53	1.146 1.013 0.861
$4d^7(a\ ^2H)5p$	$x\ ^3G^\circ$	5 4 3	*41739.30* *42939.12* *43975.79*	−1199.82 −1036.67	1.197 0.934
$4d^7(a\ ^2D)5p$	$z\ ^1D^\circ$	2	*41756.15*		1.182
$4d^7(a\ ^4F)6s$	$e\ ^3F$	4 3 2	41825.23 43115.47 44970.04	−1290.24 −1854.57	
	$v\ ^3D^\circ$	3 2 1	*41880.85* *42897.23*	−1016.38	1.163
$4d^7(a\ ^2H)5p$	$z\ ^1I^\circ$	6	*42404.14?*		
$4d^7(a\ ^2P)5p$	$z\ ^1P^\circ$	1	*42415.81*		0.965
$4d^7(a\ ^2P)5p$	$z\ ^1S^\circ$	0	*42620.80*		0/0
	A	4	42895.39		
$4d^7(a\ ^2D)5p$	$y\ ^1F^\circ$	3	*42998.31*		0.995
$4d^7(a\ ^4P)5p$	$y\ ^3S^\circ$	1	*43107.52*		1.533
	$u\ ^3D^\circ$	3 2 1	 *43509.17* *43841.53*	−332.36	 1.158 0.800

Ru I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$4d^7(a\ ^2H)5p$	$y\ ^3H^\circ$	6 5 4	*43548.67* *44109.41* *44662.01*	−560.74 −552.60	1.162 1.033 0.925
$4d^7(a\ ^2H)5p$	$y\ ^1H^\circ$	5	*43596.58*		1.03
	$w\ ^3G^\circ$	5 4 3	*43742.81* *43862.91*	−120.10	1.272
$4d^7(a\ ^2P)5p$	$y\ ^1D^\circ$	2	*43903.41*		1.026
	$2^\circ(^5G^\circ)$	6	*43998.60*		1.219
$4d^7(a\ ^2D)5p$	$z\ ^3P^\circ$	2 1 0	*44234.68*		1.422
$4d^6\ 5s(a\ ^6D)5p$	$w\ ^5D^\circ$	4 3 2 1 0	*44243.49* *45071.40* *45790.41* *46191.40* *46466.35*	−827.91 −719.01 −400.99 −274.95	1.473 1.449 1.484 1.439
	$3^\circ(^3P^\circ)$	1	*44301.14*		1.350
$4d^6\ 5s(a\ ^6D)5p$	$x\ ^5F^\circ$	5 4 3 2 1	*44321.81* *44607.61* *44800.81* *45592.33*	−285.80 −193.20 −791.52	1.303
	4°	3	*44441.59*		0.76
	$5^\circ(^5G^\circ)$	2	*44891.40*		0.383
$4d^6\ 5s(b\ ^4P)5p$	$y\ ^5S^\circ$	2	*45197.37*		2.224
$4d^7(a\ ^2F)5p$:	$x\ ^1F^\circ$	3	*45201.98*		1.059
$4d^7(a\ ^2H)5p$	$y\ ^1G^\circ$	4	*45364.72*		0.962
	6°	3	*45475.77*		1.547
$4d^7(a\ ^2F)5p$:	$x\ ^1G^\circ$	4	*45528.61*		1.08
	7°	3	*45549.51*		
$4d^7(a\ ^4F)6p$:	$w\ ^5F^\circ$	4 3 2	*45755.55* *46946.58* *47247.98*	−1191.03 −301.40	 1.022 0.702
	$t\ ^3D^\circ$	3 2 1	 *45923.36* *46499.70*	−576.34	 1.089 0.72
	8°	1	*45978.14*		0.44
	9°	1	*46056.23*		1.115
	10°	4	*46067.24*		
	11°	0	*46102.93*		0/0
	12°	4	*46273.20*		
	13°	4	*46400.58*		
$4d^6\ 5s(b\ ^2H)5p$:	$x\ ^1H^\circ$	5	*46495.05*		1.030
$4d^7(a\ ^2D)5p$:	$y\ ^1P^\circ$	1	*46528.26*		1.05
	14°	4	*46695.02*		
$4d^6\ 5s(b\ ^4P)5p$	$x\ ^5P^\circ$	3 2 1	*46746.35* *46803.60* *47500.54*	−57.25 −696.94	
	15°	1	*46789.23*		

Ru I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$4d^7(a\,^4F)5d$:	f ^5F	5 4 3 2 1	46906. 32 48543. 88 48809. 28	−1637. 56 −265. 40	
$4d^7(a\,^4F)5d$:	e ^5D	4 3 2 1 0	46972. 42 47188. 32 48720. 87 49513. 33?	−215. 90 −1532. 55 −792. 46?	1. 36
$4d^7(a\,^4F)5d$:	e ^5G	6 5 4 3 2	46991. 15 48521. 77 49553. 73	−1530. 62	
	16°	3	*47046. 54*		1. 058
$4d^7(a\,^4F)5d$:	e ^3G	5 4 3	47084. 80 48727. 68 49675. 97	−1642. 88 −948. 29	1. 19
	17°	4	*47157. 28*		1. 24
	18° ($^5D°$)	0	*47176. 90*		
	19°	4	*47261. 52*		1. 12
$4d^7(a\,^4F)6p$:	s $^3D°$	3 2 1	*47339. 32* *47547. 33*	−208. 01	1. 377 1. 057
	20° ($^5D°$)	2	*47345. 10*		1. 55
	21°	5	*47425. 17*		
	B (^5F)	4	47486. 96		
	22°	3	*47526. 09*		1. 134
	23°	3	*47635. 33*		1. 06
	24°	5	*47642. 87*		
	25°	3	*47788. 72*		
	26°	1	*47809. 11*		
	27°	4	*47817. 84*		
	28°	3	*47868. 35*		1. 309
	29°	3	*48003. 00*		
	30°	4	*48109. 32*		
	31°	4	*48143. 98*		
	32°	2	*48164. 79*		
	33°	2	*48326. 73*		1. 08
$4d^6\,5s(a\,^6D)6s$	e ^7D	5 4 3 2 1	48386. 33 49235. 15 50016. 70 50539. 81 50618. 88	−848. 82 −781. 55 −523. 11 −79. 09	1. 602 1. 649
	34°	3	*48405. 09*		1. 14
$4d^7(a\,^4F)5d$:	e ^3D	3 2 1	48489. 66 49757. 88	−1268. 22	1. 28
	35°	3	*48493. 01*		
	36°	5	*48503. 80*		
	37°	3?	*48570. 85*		

Ru I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
	38°	4	*48597. 45*		1. 206
	39°	1	*48604. 34*		2. 06
	40°	3	*48765. 88*		
	41°	2	*48779. 15*		
	42°	4	*48853. 69*		1. 23
	43°	3	*48933. 93*		
	44°	2	*49037. 35*		
	45°	1	*49047. 61*		
	46°	3	*49141. 42*		
	47°	4	*49165. 05*		
$4d^7(a\,^4P)5d$	e ^5P	3 2 1	49291. 06 50172. 84	−881. 78	
	48°	3	*49303. 88?*		
	49°	1	*49408. 97*		
	50°	2	*49417. 50*		
	51°	4?	*49447. 53*		
$4d^6\,5s(a\,^6D)5d$	e ^5S	2	49489. 56		
	C (^7F)	5	49592. 90		
$4d^6\,5s(a\,^6D)5d$:	f ^7D	5 4 3 2 1	 49624. 26 51058. 64 52729. 80	−1671. 16	
	52°	4	*49722. 18*		
	53°	1	*49761. 61*		
	54°	3?	*49918. 28?*		
	v $^3G°$	3 4 5	 *49949. 25* *50122. 41*	173. 16	1. 16
	55°	2	*49970. 65*		
	56°	2	*50027. 96*		
	57°	1	*50192. 07*		
	58°	1	*50338. 99*		
$4d^6\,5s(a\,^6D)6s$	f ^5D	4 3 2 1 0	50350. 52 51364. 82 52001. 35	−1014. 30 −636. 53	
	59°	3	*50351. 93*		
	60°	1	*50772. 05*		
	61°	4	*51360. 21*		1. 094
	D	3	52455. 23		
	62°	4	*53717. 63*		
	E	4	54043. 38		
Ru II ($^4F_{4\frac{1}{2}}$)	*Limit*	----	59410		

February 1957.

Ru I OBSERVED TERMS*

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6$ $3d^{10}\,4s^2\,4p^6+$	Observed Terms		
$4d^8$	$c\,^3P$ $b\,^1D$ $b\,^3F$ $b\,^1G$		
$4d^6\,5s^2$	$a\,^5D$ $d\,^3P?$ $b\,^3D$ $c\,^3F$ $b\,^3G$ $b\,^3H$		
	$ns\ (n\geq5)$	$np\ (n\geq5)$	$nd\ (n\geq5)$
$4d^7(a\,^4F)ns$	$a, e\,^5F$ $a, e\,^3F$	$z\,^5D^\circ$ $z\,^5F^\circ$ $z\,^5G^\circ$ $z, x{:}\,^3D^\circ$ $z, w{:}\,^3F^\circ$ $z\,^3G^\circ$	$e\,^5D{:}$ $f\,^5F{:}$ $e\,^5G{:}$ $e\,^3D{:}$ $e\,^3G{:}$
$4d^7(a\,^4P)ns$	$a\,^5P$ $b\,^3P$	$z\,^5S^\circ$ $y\,^5P^\circ$ $z\,^5D^\circ$ $z\,^3S^\circ$ $z\,^3P^\circ$ $y\,^3D^\circ$	$e\,^5P$
$4d^6\,5s(a\,^6D)ns$	$e\,^7D$ $f\,^5D$	$z\,^7P^\circ$ $z\,^7D^\circ$ $z\,^7F^\circ$ $z\,^5P^\circ$ $y\,^5D^\circ$ $y\,^5F^\circ$	$e\,^7S$ $f\,^7D{:}$
$4d^7(a\,^2G)ns$	$a\,^3G$ $a\,^1G$	$y\,^3F^\circ$ $y\,^3G^\circ$ $z\,^3H^\circ$ $z\,^1F^\circ$ $z\,^1G^\circ$ $z\,^1H^\circ$	
$4d^7(a\,^2P)ns$	$a\,^3P$ $a\,^1P$	$y\,^3S^\circ$ $y\,^3P^\circ$ $x\,^3D^\circ$ $z\,^1S^\circ$ $z\,^1P^\circ$ $y\,^1D^\circ$	
$4d^7(a\,^2D)ns$	$a\,^3D$ $a\,^1D$	$x\,^3P^\circ$ $w\,^3D^\circ$ $x\,^3F^\circ$ $y\,^1P^\circ{:}$ $z\,^1D^\circ$ $y\,^1F^\circ$	
$4d^7(a\,^2H)ns$	$a\,^3H$ $a\,^1H$	$x\,^3G^\circ$ $y\,^3H^\circ$ $z\,^3I^\circ$ $y\,^1G^\circ$ $y\,^1H^\circ$ $z\,^1I^\circ$	
$4d^6\,5s(a\,^4D)ns$		$w\,^5D^\circ$ $x\,^5F^\circ$	
$4d^7(a\,^2F)ns$	$d\,^3F{:}$	$x\,^1F^\circ{:}$ $x\,^1G^\circ{:}$	
$4d^6\,5s(b\,^4P)ns$		$y\,^5S^\circ$ $x\,^5P^\circ$	
$4d^6\,5s(b\,^2H)ns$		$z\,^5H^\circ{:}$	

*For predicted terms in the spectra of the Ru I isoelectronic sequence, see Vol. III, Introduction.

Ru II

(Tc I sequence; 43 electrons) $Z=44$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^7\ ^4F_{4\frac{1}{2}}$

$a\ ^5D_4$ 135200 K I. P. 16.76 volts

The analysis is mostly by Shenstone, who placed Ru II on his program especially in order to provide the data for inclusion here, since the first regularities reported by Meggers and himself in 1930 had not been extended. A complete description of the spectrum, together with measurements for Zeeman patterns from the Massachusetts Institute of Technology spectrograms, was furnished him by Meggers. The Bureau observations extend from 2005.69 A to 6662.68 A. These were supplemented by Princeton observations in the short-wave region extending to 1055 A.

There are about 1400 classified lines, including nearly all of the stronger lines. Observed intersystem combinations connect the terms of different multiplicity. It is noteworthy that all terms from the $4d^7$ configuration have been found.

The limit is from Catalán and Rico who have derived it by a comparison of second spectra from Sr to Cd.

REFERENCES

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W. F. Meggers, unpublished material (May 1955). (Z E).
M. A. Catalán y F. R. Rico, letter (December 1956). (I P)
A. G. Shenstone, unpublished material (October 1957). (I P) (T) (C L) (Z E).

Ru II

Config.	Desig.	J	Level	Interval	Obs. g
$4d^7$	$a\ ^4F$	4½	0.0	−1522.4	
		3½	1522.4	−970.8	
		2½	2494.2	−610.5	
		1½	3104.7		
$4d^7$	$a\ ^4P$	2½	8256.7	−220.7	1.57
		1½	8477.4	−896.0	1.68
		0½	9373.4		2.61
$4d^6(^5D)5s$	$a\ ^6D$	4½	9151.5	−999.1	1.54
		3½	10150.6	−701.2	1.576
		2½	10851.8	−451.8	1.637
		1½	11303.6	−300.5	1.843
		0½	11604.1		3.271
$4d^7$	$a\ ^2G$	4½	10860.9	−1432.5	
		3½	12293.4		
$4d^7$	$a\ ^2P$	1½	12956.6	−1842.9	
		0½	14799.5		
$4d^7$	$a\ ^2D$	2½	14581.2	−2436.4	1.27
		1½	17017.6		
$4d^7$	$a\ ^2H$	5½	14663.4	−1461.6	
		4½	16125.0		
$4d^6(^5D)5s$	$a\ ^4D$	3½	19378.7	−1136.2	1.403
		2½	20514.9	−731.3	1.337
		1½	21246.2	−399.3	1.188
		0½	21645.5		0.0
$4d^7$	$a\ ^2F$	2½	21557.8	731.2	0.864
		3½	22289.0		1.141
$4d^6(^3H)5s$	$a\ ^4H$	6½	25952.2	−157.3	1.23
		5½	26109.5	−8.9	1.16
		4½	26118.4	−349.7	1.14
		3½	26468.1		0.753
$4d^6(^3P)5s$	$b\ ^4P$	2½	26911.4	−2179.6	1.572
		1½	29091.0	−1398.3	1.636
		0½	30489.3		2.541
$4d^6(^3F)5s$	$b\ ^4F$	4½	27544.6	−404.2	1.200
		3½	27948.8	−190.0	1.092
		2½	28138.8	−356.5	0.940
		1½	28495.3		0.415
$4d^6(^3G)5s$	$a\ ^4G$	5½	29018.6	−1081.1	1.237
		4½	30099.7	−339.9	1.167
		3½	30439.6	146.5	1.021
		2½	30293.1		0.649
$4d^6(^3H)5s$	$b\ ^2H$	5½	32623.0	−63.7	1.072
		4½	32686.7		0.958
$4d^6(^3D)5s$	$b\ ^4D$	0½	32960.9	−72.5	0.135
		1½	32888.4	130.6	1.200
		2½	33019.0	313.5	1.344
		3½	33332.5		1.397
$4d^6(^3P)5s$	$b\ ^2P$	1½	33734.9	−2360.0	1.188
		0½	36094.9		0.870
$4d^6(^3F)5s$	$b\ ^2F$	3½	34038.4	−1260.1	1.063
		2½	35298.5		0.945
$4d^7$	$b\ ^2D$	1½	34793.3	35.9	0.965
		2½	34829.2		1.102
$4d^5\ 5s^2$	$a\ ^6S$	2½	35857.6		
$4d^6(^1I)5s$	$a\ ^2I$	6½	35939.7	−290.1	1.08
		5½	36229.8		0.90
$4d^6(^3G)5s$	$b\ ^2G$	4½	36016.0	−499.8	1.067
		3½	36515.8		0.888

Ru II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$4d^6(^3G)5s$	$c\ ^2G$	4½	37432.1	−548.5	1.078
		3½	37981.6		0.942
$4d^6(^3D)5s$	$c\ ^2D$	2½	38981.9	−730.1	1.2
		1½	39712.0		0.789
$4d^6(^1S)5s$	$a\ ^2S$	0½	40226.2		2.0?
$4d^6(^1D)5s$	$d\ ^2D$	1½	42750.2	859.7	0.80
		2½	43609.9		1.20
$4d^6(^5D)5p$	$z\ ^6D^\circ$	4½	46470.9	−240.5	1.530
		3½	46711.4	−573.5	1.568
		2½	47284.9	−423.5	1.634
		1½	47708.4	−275.3	1.840
		0½	47983.7		3.288
$4d^6(^5D)5p$	$z\ ^6F^\circ$	5½	50758.2	−87.1	1.45
		4½	50845.3	−17.2	1.43
		3½	50862.5	−316.9	1.457
		2½	51179.4	−137.2	1.302
		1½	51316.6	−63.2	1.046
		0½	51379.8		−0.59
$4d^6(^5D)5p$	$z\ ^6P^\circ$	3½	51548.8	−1271.5	1.580
		2½	52820.3	−864.8	1.885
		1½	53685.1		2.365
$4d^6(^5D)5p$	$z\ ^4F^\circ$	4½	52964.3	−1261.1	1.346
		3½	54225.4	−568.8	1.262
		2½	54794.2	−429.7	1.071
		1½	55223.9		0.470
$4d^6(^5D)5p$	$z\ ^4D^\circ$	3½	53316.9	−748.2	1.40
		2½	54065.1	−598.1	1.347
		1½	54663.2	−318.0	1.143
		0½	54981.2		0.0
$4d^6(^5D)5p$	$z\ ^4P^\circ$	2½	55694.9	−969.7	1.571
		1½	56664.6	−598.7	1.712
		0½	57263.3		2.648
$4d^6(^3P)5p$	$z\ ^4S^\circ$	1½	62446.3		1.789
$4d^6(^3H)5p$	$z\ ^4H^\circ$	3½	62526.6	380.7	0.960
		4½	62907.3	400.5	1.023
		5½	63307.8	280.5	1.088
		6½	63588.3		1.13
$4d^6(^3H)5p$	$z\ ^4G^\circ$	5½	63518.5	−332.8	1.24
		4½	63851.3	−89.8	1.183
		3½	63941.1	−84.2	0.979
		2½	64025.3		0.646
$4d^6(^3P)5p$	$y\ ^4P^\circ$	2½	63797.3	−1710.8	1.295
		1½	65508.1		1.85?
		0½			
$4d^6(^3H)5p$	$z\ ^4I^\circ$	4½	64385.3	1086.9	0.960
		5½	65472.2	726.6	1.052
		6½	66198.8	−939.0	1.03
		7½	65259.8?		
$4d^6(^3F)5p$	$y\ ^4F^\circ$	1½	64921.7	−457.9	0.428
		2½	64463.8	285.0	1.022
		3½	64748.8	577.8	1.044
		4½	65326.6		1.132
$4d^6(^3H)5p$	$z\ ^2G^\circ$	3½	65213.0	563.3	1.032
		4½	65776.3		0.994
$4d^6(^3P)5p$	$z\ ^2D^\circ$	2½	65244.8		1.325
		1½			
$4d^6(^3H)5p$	$z\ ^2I^\circ$	6½	65546.6	−702.8	1.12
		5½	66249.4		1.05
$4d^6(^3F)5p$	$z\ ^2F^\circ$	3½	66012.3	−1086.9	1.199
		2½	67099.2		0.850

Ru II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$4d^6(^3P)5p$	$y\ ^4D^\circ$	3½	66338.0	−2436.0	1.343
		2½	68774.0	874.0	1.306
		1½	67900.0	1266.7	1.234
		0½	66633.3		0.775
$4d^6(^3F)5p$	$x\ ^4D^\circ$	0½	68097.0	−993.8	0.385
		1½	67103.2	−452.5	1.187
		2½	66650.7	1578.5	1.281
		3½	68229.2		0.961
$4d^6(^3F)5p$	$y\ ^4G^\circ$	5½	67601.7	436.3	1.164
		4½	67165.4	−480.7	1.158
		3½	67646.1	−300.6	1.02
		2½	67946.7		0.687
$4d^6(^3H)5p$	$z\ ^2H^\circ$	5½	67501.4	−619.0	1.13
		4½	68120.4		1.013
$4d^6(^3G)5p$	$x\ ^4F^\circ$	4½	67901.3	−1502.7	1.19
		3½	69404.0	−242.6	1.059
		2½	69646.6	26.5	0.98
		1½	69620.1		0.65
$4d^6(^3F)5p$	$y\ ^2G^\circ$	3½	68265.6	915.3	1.028
		4½	69180.9		1.055
$4d^6(^3G)5p$	$x\ ^4G^\circ$	5½	68328.3	−578.2	1.152
		4½	68906.5	−646.1	1.21
		3½	69552.6	498.0	1.02
		2½	69054.6		0.706
$4d^6(^3P)5p$	$z\ ^2P^\circ$	1½	68445.9	−993.6	1.16
		0½	69439.5		0.829
$4d^6(^3G)5p$	$y\ ^4H^\circ$	6½	69311.2	−335.6	1.196
		5½	69646.8	34.0	1.12
		4½	69612.8	−42.6	1.0
		3½	69655.4		0.798
	1°	1½	70150.7?		1.209
$4d^6(^3F)5p$	$y\ ^2D^\circ$	2½	70571.1	−208.4	1.157
		1½	70779.5		0.745
$4d^6(^3P)5p$	$z\ ^2S^\circ$	0½	71036.2		2.047
$4d^6(^3D)5p$	$x\ ^4P^\circ$	2½	71115.0	−751.5	1.246
		1½	71866.5	−1329.0	1.567
		0½	73195.5		1.749
$4d^6(^3G)5p$	$y\ ^2H^\circ$	5½	71202.9	−723.6	0.73?
		4½	71926.5		0.98
$4d^6(^3G)5p$	$y\ ^2F^\circ$	2½	71598.6	411.9	1.17?
		3½	72010.5		1.116
$4d^6(^3D)5p$	$x\ ^2F^\circ$	2½			
		3½	72248.5		1.137
$4d^6(^3D)5p$	$w\ ^4F^\circ$	1½	72523.5	446.7	0.490
		2½	72970.2	171.9	0.9
		3½	73142.1	76.2	1.30
		4½	73218.3		1.30
$4d^5 5s(^7S)5p$	$y\ ^6P^\circ$	1½	72760.7	148.1	
		2½	72908.8	304.4	
		3½	73213.2		1.712
	2°	1½	72786.0		
$4d^6(^1I)5p$	$z\ ^2K^\circ$	7½	72903.0?	−339.0	
		6½	73242.0?		
$4d^6(^3D)5p$	$w\ ^4D^\circ$	0½	73749.5	−433.7	0.552
		1½	73316.8	−31.8	1.20
		2½	73284.0	1310.0	1.30
		3½	74594.0		1.13

Ru II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$4d^6(^1I)5p$	$z\ ^2H^\circ$	4½ 5½	*73363.4* *73950.6*	587.2	0.96 1.09
$4d^6(^3G)5p$	$z\ ^2G^\circ$	3½ 4½	*73810.2* *74045.8*	235.6	1.114 0.713
$4d^6(^3D)5p$	$z\ ^2D^\circ$	1½ 2½	*74592.3* *75117.4*	525.1	0.8 1.2
$4d^6(^1G)5p$	$w\ ^2G^\circ$	4½ 3½	*75346.3* *75431.7*	−85.4	1.05? 0.911
$4d^6(^1G)5p$	$w\ ^2H^\circ$	5½ 4½	*75662.1* *76389.0*	−726.9	1.08 0.94
$4d^6(^1I)5p$	$y\ ^2I^\circ$	6½ 5½	*75789.5* *75925.4*	−135.9	1.08 0.92
$4d^6(^1G)5p$	$w\ ^2F^\circ$	3½ 2½	*76977.0*		1.14
$4d^6(^1D)5p$	$y\ ^2P^\circ$	1½ 0½	*77898.7*		1.33
$4d^6(^1D)5p$	$w\ ^2D^\circ$	2½ 1½	*77819.0* *78617.1*	−798.1	1.07 0.86
$4d^6(^1D)5p$	$v\ ^2F^\circ$	2½ 3½	*79114.9* *79804.0*	689.1	1.0 1.046
	3°	3½	*79503.6*		1.083
$4d^5\ 5s(^5S)5p$	$w\ ^4P^\circ$	2½ 1½ 0½	*81721.7* *82239.5* *82650.8*	−517.8 −411.3	
$4d^6(^5D)6s$	$e\ ^6D$	4½ 3½ 2½ 1½ 0½	84510.9		
$4d^6(^5D)6s$	$e\ ^4D$	3½ 2½ 1½ 0½	86440.4 87523.4	−1083.0	
$4d^5\ 5s(^5S)6p$	$x\ ^6P^\circ$	3½ 2½ 1½	*90165.2* *90829.9* *91503.7*	−664.7 −673.8	
Ru III ($^5D_4$)	*Limit*	-----	135200		

October 1957.

Ru II Observed Terms*

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6+$	Observed Terms	
$4d^7$	$a\ ^4P$ $a\ ^4F$ $a\ ^2P$ $a\ ^2D$ $a\ ^2F$ $a\ ^2G$ $a\ ^2H$ $b\ ^2D$	
$4d^5\ 5s^2$	$a\ ^6S$	
	$ns\ (n\geq 5)$	$np\ (n\geq 5)$
$4d^6(^5D)nx$	$a, e\ ^6D$ $a, e\ ^4D$	$z\ ^6P^\circ$ $z\ ^6D^\circ$ $z\ ^6F^\circ$ $z\ ^4P^\circ$ $z\ ^4D^\circ$ $z\ ^4F^\circ$
$4d^5\ 5s(^7S)nx$		$y\ ^8P^\circ$
$4d^5\ 5s(^5S)nx$		$x\ ^6P^\circ$ $w\ ^4P^\circ$
$4d^6(^3H)nx$	$a\ ^4H$ $b\ ^2H$	$z\ ^4G^\circ$ $z\ ^4H^\circ$ $z\ ^4I^\circ$ $z\ ^2G^\circ$ $z\ ^2H^\circ$ $z\ ^2I^\circ$
$4d^6(^3P)nx$	$b\ ^4P$ $b\ ^2P$	$z\ ^4S^\circ$ $y\ ^4P^\circ$ $y\ ^4D^\circ$ $z\ ^2S^\circ$ $z\ ^2P^\circ$ $z\ ^2D^\circ$
$4d^6(^3F)nx$	$b\ ^4F$ $b\ ^2F$	$x\ ^4D^\circ$ $y\ ^4F^\circ$ $y\ ^4G^\circ$ $y\ ^2D^\circ$ $z\ ^2F^\circ$ $y\ ^2G^\circ$
$4d^6(^3G)nx$	$a\ ^4G$ $b\ ^2G$	$x\ ^4F^\circ$ $x\ ^4G^\circ$ $y\ ^4H^\circ$ $y\ ^2F^\circ$ $x\ ^2G^\circ$ $y\ ^2H^\circ$
$4d^6(^3D)nx$	$b\ ^4D$ $c\ ^2D$	$x\ ^4P^\circ$ $w\ ^4D^\circ$ $w\ ^4F^\circ$ $x\ ^2D^\circ$ $x\ ^2F^\circ$
$4d^6(^1I)nx$	$a\ ^2I$	$x\ ^2H^\circ$ $y\ ^2I^\circ$ $z\ ^2K^\circ$
$4d^6(^1G)nx$	$c\ ^2G$	$w\ ^2F^\circ$ $w\ ^2G^\circ$ $w\ ^2H^\circ$
$4d^6(^1S)nx$	$a\ ^2S$	
$4d^6(^1D)nx$	$d\ ^2D$	$y\ ^2P^\circ$ $w\ ^2D^\circ$ $v\ ^2F^\circ$

*For predicted terms in the spectra of the Tc I isoelectronic sequence, see Volume III, Introduction.

Ru III

(Mo I sequence; 42 electrons) $Z=44$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^6\ {}^5D_4$

$4d^6\ {}^5D_4$ 229600 K I. P. 28.46 volts

The analysis is by Shenstone, who has investigated Ru III especially for inclusion here. He has observed the spectrum from 600 A to 4004 A and classified 40 lines. The quintet and septet systems of terms are connected by observed intersystem combinations.

He derives the limit 225900 from the ns series by means of a Ritz formula, with $\alpha=1.033\times10^{-6}$. This value of α represents $\alpha(\text{Fe III})\times\{\alpha(\text{Ag II})/\alpha(\text{Cu II})\}$. Catalán and Rico have interpolated the quoted limit by comparison of the third spectra from Y to In.

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M. A. Catalán y F. R. Rico, An. Real Soc. Esp. Fisica y Quimica (Madrid) [A] **53**, 85 (1957). (I P)

Ru III

Config.	Desig.	J	Level	Interval
$4d^6$	$4d^6\ {}^5D$	4	0.0	
		3	1158.8	−1158.8
		2	1826.3	−667.5
		1	2266.3	−440.0
		0	2476.0	−209.7
$4d^5(^6S)5s$	$5s\ {}^7S$	3	27162.8	
$4d^5(^6S)5s$	$5s\ {}^5S$	2	41111.7	
$4d^5(^6S)5p$	$5p\ {}^7P^\circ$	2	*76056.1*	
		3	*76915.6*	859.5
		4	*78673.5*	1757.9
$4d^5(^6S)5p$	$5p\ {}^5P^\circ$	3	*83997.9*	
		2	*84487.1*	−489.2
		1	*84822.9*	−335.8
$4d^5(^6S)5d$	$5d\ {}^7D$	1	137218.6?	
		2	137251.0	32.4
		3	137303.6	52.6
		4	137383.8	80.2
		5	137502.6	118.8
$4d^5(^6S)6s$	$6s\ {}^7S$	3	137482.3	
$4d^5(^6S)6s$	$6s\ {}^5S$	2	139692.3	
$4d^5(^6S)5d$	$5d\ {}^5D$	0		
		1	140345.8?	
		2	140487.6	141.8
		3	140447.2	−40.4
		4	140419.5	−27.7
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Ru IV ($^5S_{2\frac{1}{2}}$)	*Limit*	----	229600	

February 1957.

RHODIUM

Rh I

45 electrons $Z=45$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^8\ 5s\ {}^4F_{4\frac{1}{2}}$

$a\ {}^4F_{4\frac{1}{2}}$ 60197 K I. P. 7.46 volts

The first spectrum of rhodium has a unique place in the history of atomic spectra. In 1901 C. P. Snyder published an array of Rh I wave numbers consisting of 19 columns and 54 rows, accounting for 476 Rh I lines. The significance of this work was not appreciated until years later when regularities were found in many spectra. It may be said fairly that this work anticipated by years the long series of investigations culminating in the Hund theory of atomic spectra. All efforts to contact this author have failed—and yet spectroscopists are deeply indebted to him for his remarkable pioneer work illustrating in detail the correct approach to the study of complex spectra.

In 1927 Sommer extended the early work on this spectrum by Meggers and Laporte. He published an extensive analysis including about 1000 classified lines between 2288.53 A and 8425.51 A, 136 energy levels, and numerous Zeeman observations. He derived the limit 62000 K from the ${}^4F$- and ${}^2F$-series of two members each, by using a Rydberg formula.

Subsequently Molnar and Hitchcock observed the Rh I spectrum at the Massachusetts Institute of Technology, and revised the analysis with the aid of extensive Zeeman observations made with the Bitter magnet. The data in the table are from their paper. They derived improved values for the energy levels throughout the spectrum, added 14 energy levels, and rejected 19 of Sommer's miscellaneous levels. Of these, one at 532 [illegible] may be a misprint for a possible level at 53223.85 with $J=1\frac{1}{2}$ or $2\frac{1}{2}$. Two others at 55898.60 ($J=2\frac{1}{2}$) and 63891.07 ($J=3\frac{1}{2}$), respectively, may be real, although the combinations are limited to faint lines. There are about 950 classified lines between 1987.84 A and 8615.23 A. The doublet and quartet systems of terms are connected by observed intersystem combinations. The following changes in notation have been introduced into the table:

Designation

Molnar and Hitchcock	Adopted AEL
$e\ {}^2D$	$a\ {}^2D$
$a\ {}^2D$	$b\ {}^2D$
$c\ {}^2F$	$e\ {}^2F$
$c\ {}^4F$	$e\ {}^4F$
$z\ {}^2P^\circ$	$y\ {}^2P^\circ$
$y\ {}^2P^\circ$	$z\ {}^2P^\circ$
$z\ {}^2F^\circ$	$y\ {}^2F^\circ$
$y\ {}^2F^\circ$	$z\ {}^2F^\circ$

Rh I—Continued

The writer has also interchanged the configuration assignments of the two $^2P^\circ$ terms having singlet limits so that the lower one, here called $y\ ^2P^\circ$, has the limit ^1D, and the next higher one, $z\ ^2P^\circ$, has the limit ^1S.

Murphy has recently extended the observations between 6332.96 A and 11021.74 A. He has added 53 classified lines and the two levels $b\ ^4P_{1\frac{1}{2}}$ and $b\ ^2G_{3\frac{1}{2}}$. The remaining levels of these terms have been furnished by the writer. A homogeneous line list and further analysis are needed. No sextet terms have been found, no terms involving d-electrons are known, and many miscellaneous levels should be assigned their proper term designations and configurations.

The limit quoted here is from Catalán and Rico. They have derived it from a study of the series in the spectra Rh I to Ag I.

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Rh I

Config.	Desig.	J	Level	Interval	Obs. g
$4d^8(^3F)5s$	$a\ ^4F$	4½	0.00	−1529.97	1.329
		3½	1529.97	−1068.06	1.230
		2½	2598.03	−874.65	1.105
		1½	3472.68		0.473
$4d^9$	$a\ ^2D$	2½	3309.86	−2348.11	1.116
		1½	5657.97		0.744
$4d^8(^3F)5s$	$a\ ^2F$	3½	5690.97	−2100.26	1.143
		2½	7791.23		0.947
$4d^8(^3P)5s$	$a\ ^4P$	2½	9221.22	−1092.19	1.478
		1½	10313.41	−692.64	1.576
		0½	11006.05		2.661
$4d^8(^3P)5s$	$a\ ^2P$	1½	11968.23	−2006.50	1.230
		0½	13974.73		0.681
$4d^7\ 5s^2$	$b\ ^4F$	4½	12723.07	−2064.80	1.317
		3½	14787.87	−1330.82	1.230
		2½	16118.69	−824.81	1.018
		1½	16943.50		0.416
$4d^8(^1D)5s$	$b\ ^2D$	2½	13520.69	−861.50	1.233
		1½	14382.19		1.034
$4d^8(^1G)5s$	$a\ ^2G$	4½	16017.94	−102.78	1.114
		3½	16120.72		0.900
$4d^7\ 5s^2$	$b\ ^4P$	2½	23157.57	−498.36	
		1½	23655.93	−1032.07	
		0½	24686.00		
$4d^7\ 5s^2$	$b\ ^2G$	4½	25820.80	−2055.72	
		3½	27876.52		
$4d^8(^3F)5p$	$z\ ^4D^\circ$	3½	*27075.26*	−1784.38	1.410
		2½	*28859.64*	−1537.63	1.330
		1½	*30397.27*	−749.41	1.165
		0½	*31146.68*		0.040
$4d^8(^3F)5p$	$z\ ^4G^\circ$	5½	*29104.71*	562.02	1.273
		4½	*28542.69*	−2559.06	1.181
		3½	*31101.75*	−1141.57	1.023
		2½	*32243.32*		0.937
$4d^8(^3F)5p$	$z\ ^4F^\circ$	4½	*29430.86*	−435.48	1.261
		3½	*29866.34*	−1608.16	1.148
		2½	*31474.50*	−802.93	0.834
		1½	*32277.43*		0.556
$4d^8(^3F)5p$	$z\ ^2G^\circ$	4½	*31613.78*	−1430.13	1.156
		3½	*33043.91*		0.991
$4d^8(^3F)5p$	$z\ ^2F^\circ$	3½	*32004.01*	−1942.33	1.120
		2½	*33946.34*		1.011
$4d^8(^3F)5p$	$z\ ^2D^\circ$	2½	*32046.32*	−1820.72	0.999
		1½	*33867.04*		0.913
$4d^8(^3P)5p$	$z\ ^4P^\circ$	2½	*35333.85*	−70.39	1.470
		1½	*35404.24*	−265.26	1.451
		0½	*35669.50*		2.064
	1°	3½	*36132.72*		1.473
$4d^8(^3P)5p$	$y\ ^4D^\circ$	3½	*36787.48*	−197.77	1.346
		2½	*36985.25*	−1052.87	1.150
		1½	*38038.12*	−436.31	1.134
		0½	*38474.43*		−0.160
	2°	2½	*37300.50*		1.400
$4d^8(^3P)5p$	$z\ ^2P^\circ$	0½	*37368.62*	842.34	1.342
		1½	*38210.96*		1.210
	3°	3½	*38012.75*		1.436
	4°	1½	*38668.*[illegible]		[illegible]
$4d^8(^3P)5p$	$y\ ^2D^\circ$	2½	*38718.11*	−807.17	
		1½	*39525.28*		1.494
	5°	0½	*38806.64*		−0.072
	6°	2½	*39126.76*		1.323
$4d^8(^1D)5p$	$y\ ^2P^\circ$	1½	*39231.38*	−4497.64	1.263
		0½	*43729.02*		0.687
	7°	3½	*39494.00*		1.180
	8°	2½	*39788.09*		1.111

Rh I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
	9°	2½	39981.30		1.045
	10°	1½	40134.42		1.230
$4d^8(^1D)5p$	$y\ ^2F°$	3½ 2½	40884.83 40576.95	−292.12	1.204 1.068
$4d^8(^1S)5p$	$x\ ^2P°$	1½ 0½	40603.48		1.268
$4d^8(^3P)5p$	$z\ ^2S°$	0½	40604.52		1.870
$4d^8(^3P)5p$	$z\ ^4S°$	1½	40900.00		1.232
	11°	2½	41443.67		1.983
$4d^8(^3F)6s$	$e\ ^4F$	4½ 3½ 2½ 1½	41880.86 44444.52 45471.24 45811.72	−2563.66 −1026.72 −340.48	1.31 1.22
	12°	4½	41953.07		1.127
$4d^8(^3F)6s$	$e\ ^2F$	3½ 2½	42292.51 44474.68	−2182.17	
	13°	4½	42325.46		1.113
$4d^8(^1D)5p$	$x\ ^2D°$	1½ 2½	42431.48 43421.40	989.92	1.346 1.008
	14°	3½	42495.48		1.231
	15°	4½	43042.31		1.119
	16°	3½	43047.54		1.139
$4d^8(^1G)5p$	$z\ ^2H°$	5½ 4½	43070.04		1.097
$4d^8(^1G)5p$	$x\ ^2F°$	2½ 3½	43777.07 43904.73	127.66	0.957 1.069
	17°	3½	44588.12		1.260
	18°	1½	44620.63		0.520
	19°	2½	44786.67		0.654
$4d^8(^1G)5p$	$y\ ^2G°$	3½ 4½	45177.63 45315.54	137.91	0.948 1.106
	20°	2½	45683.41		1.237
	21°	1½	46280.09		1.089
	22°	4½	46511.10		1.115
	23°	0½	46752.86		0.024
	1	3½	47713.63		1.38
	2	5½	47793.54		1.12
	3	2½ ?	47832.35		1.33
	4	4½	47857.39		1.25

Rh I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
	5	4½, 5½	47862.14		
	6	3½	47896.92		
	7	4½	47928.07		1.15
	24°	2½	47954.20		−0.083
	8	2½	48239.04		1.20
	25°	2½	48797.74		1.066
	26°	3½	48811.47		0.928
	27°	2½	49713.30		
	9	2½	50042.87		
	10	1½, 2½	50111.87		1.36
	28°	2½	50146.60		
	11	3½, 4½	50190.80		1.00
	12	5½	50199.18		1.12
	13	2½	50207.73		
	14	3½	50233.05		1.12
	15	3½, 4½	50277.62		1.15
	16	3½	50284.72		0.97
	17	1½	50290.06		
	18	2½	50408.21		1.02
	19	1½	50451.97		
	29°	1½	50721.44		
	20	2½	51324.35		
	21	3½	51356.22		0.74
	22	1½, 2½	51419.45		
	23	2½, 3½	51477.77		
	30°	2½, 3½	51608.71		
	24	1½	51636.54		0.92
	31°	3½	52065.37		0.960
	25	1½	52413.28		
	26	0½, 1½	52473.55		
	32°	1½, 2½	53599.28		
	27	1½	56087.60		
	28	1½, 2½	57610.48		
Rh II ($^3F_4$)	*Limit*	------	60197		

February 1955.

Rh I Observed Terms*

Configuration $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10}$ $4s^2 4p^6+$	Observed Terms	
$4d^9$	$a\ ^2D$	
$4d^7 5s^2$	$b\ ^4P$ $b\ ^4F$ $b\ ^2G$	
	$ns\ (n\geq 5)$	$np\ (n\geq 5)$
$4d^8(^3F)ns$	$a, e\ ^4F$ $a, e\ ^2F$	$z\ ^4D°$ $z\ ^4F°$ $z\ ^4G°$ $z\ ^2D°$ $z\ ^2F°$ $z\ ^2G°$
$4d^8(^3P)ns$	$a\ ^4P$ $a\ ^2P$	$z\ ^4S°$ $z\ ^4P°$ $y\ ^4D°$ $z\ ^2S°$ $z\ ^2P°$ $y\ ^2D°$
$4d^8(^1D)ns$	$b\ ^2D$	$y\ ^2P°$ $x\ ^2D°$ $y\ ^2F°$
$4d^8(^1G)ns$	$a\ ^2G$	$x\ ^2F°$ $y\ ^2G°$ $z\ ^2H°$
$4d^8(^1S)ns$		$x\ ^2P°$

*For predicted terms of the Rh I isoelectronic sequence, see Vol. III, Introduction.

Rh II

(Ru I sequence; 44 electrons) $Z=45$

Ground state $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^8\ ^3F_4$

$a\ ^3F_4$ **145800 K** I. P. 18.07 volts

The analysis is by Sancho, who has revised and extended the earlier work on Rh II by Livingood and Shenstone, and by Hitchcock. From spectrograms made at Princeton by Catalán, he has prepared a new line list extending from 1100 A to 4800 A. There are 494 classified lines. Observed intersystem combinations connect the systems of terms having different multiplicity.

The limit has been interpolated by Catalán and Rico from a study of the *ns* series of the spectra Sr II to Cd II.

The following observed *g*-values have been furnished by van Kleef:

Desig.	J	Obs. g	Desig.	J	Obs. g
$a\ ^5F$	5 4	1.37 1.31	$z\ ^5F°$	5 4 3	1.43 1.38 1.32
			$z\ ^5D°$	4	1.38

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W. J. Hitchcock, unpublished material (March 1952). (T) (C L)
Th. A. M. van Kleef, unpublished material (September 1956). (Z E)
F. J. Sancho, unpublished material (November 1956). (T) (C L)
M. A. Catalán y F. R. Rico, letter (December 1956). (I P)

Rh II

Config.	Desig.	J	Level	Interval
$4d^8$	$a\ ^3F$	4 3 2	0.0 2401.3 3580.7	−2401.3 −1179.4
$4d^8$	$a\ ^1D$	2	8164.4	
$4d^8$	$a\ ^3P$	0 1 2	10760.8 10515.0 11643.7	−245.8 1128.7

Rh II

Config.	Desig.	J	Level	Interval
$4d^8$	$a\ ^1G$	4	14855.4	
$4d^7(a\ ^4F)5s$	$a\ ^5F$	5 4 3 2 1	16884.8 18540.4 19792.4 20646.9 21180.0	−1655.6 −1252.0 −854.5 −533.1

Rh II—Continued

Config.	Desig.	J	Level	Interval
$4d^7(a\,^4F)5s$	$b\,^3F$	4	25376.9	−2062.5
		3	27439.4	−1395.2
		2	28834.6	
$4d^7(a\,^4P)5s$	$a\,^5P$	3	27801.4	−330.0
		2	28131.4	−941.6
		1	29073.0	
$4d^7(a\,^2G)5s$	$a\,^3G$	5	31730.5	−874.2
		4	32604.7	−1240.7
		3	33845.4	
$4d^7(a\,^2P)5s$	$b\,^3P$	2	34243.0	−483.1
		1	34726.1	−285.9
		0	35012.0	
$4d^7(a\,^2H)5s$	$a\,^3H$	6	35787.2	−1007.3
		5	36794.5	−2148.7
		4	38943.2	
$4d^7(a\,^4P)5s$	$c\,^3P$	2	36366.3	−343.7
		1	36710.0	
		0		
$4d^7(a\,^2G)5s$	$b\,^1G$	4	36486.4	
$4d^7(a\,^2D)5s$	$a\,^3D$	3	36938.9	−1683.4
		2	38622.3	−65.2
		1	38687.5	
$4d^7(a\,^2H)5s$	$a\,^1H$	5	41045.3	
$4d^7(a\,^2D)5s$	$b\,^1D$	2	42872.3	
$4d^7(a\,^4F)5p$	$z\,^5F^\circ$	5	*57020.8*	473.5
		4	*56547.3*	−1811.2
		3	*58358.5*	−1340.1
		2	*59698.6*	−874.6
		1	*60573.2*	
$4d^7(a\,^4F)5p$	$z\,^5D^\circ$	4	*59161.5*	−1286.9
		3	*60448.4*	−907.5
		2	*61355.9*	−525.2
		1	*61881.1*	−131.4
		0	*62012.5*	
$4d^7(a\,^4F)5p$	$z\,^5G^\circ$	6	*59702.4*	−27.0
		5	*59729.4*	−1443.7
		4	*61173.1*	−766.7
		3	*61939.8*	−348.5
		2	*62288.3*	
$4d^7(a\,^4F)5p$	$z\,^3G^\circ$	5	*62194.4*	−1765.1
		4	*63959.5*	−1361.7
		3	*65321.2*	
$4d^7(a\,^4F)5p$	$z\,^3F^\circ$	4	*62326.1*	−1128.8
		3	*63454.9*	−1515.5
		2	*64970.4*	
$4d^7(a\,^4P)5p$	$z\,^5S^\circ$	2	*63261.4*	
$4d^7(a\,^4F)5p$	$z\,^3D^\circ$	3	*64819.4*	−1259.4
		2	*66078.8*	−690.9
		1	*66769.7*	
$4d^7(a\,^4P)5p$	$z\,^5P^\circ$	1	*69022.9*	17.5
		2	*69040.4*	114.7
		3	*69155.1*	
$4d^7(a\,^2G)5p$	$y\,^3F^\circ$	4	*70038.3*	−2265.4
		3	*72303.7*	−2848.7
		2	*75152.4*	
$4d^7(a\,^4P)5p$	$y\,^5D^\circ$	0	*70199.2*	343.0
		1	*70542.2*	816.4
		2	*71358.6*	349.1
		3	*71707.7*	−702.0
		4	*71005.7*	

Rh II—Continued

Config.	Desig.	J	Level	Interval
$4d^7(a\,^2G)5p$	$z\,^3H^\circ$	6	*72112.1*	1469.1
		5	*70643.0*	−1517.4
		4	*72160.4*	
$4d^7(a\,^2P)5p$	$z\,^3P^\circ$	2	*72128.5*	−1517.8
		1	*73646.3*	
		0		
$4d^7(a\,^2P)5p$	$z\,^3S^\circ$	1	*72331.5*	
$4d^7(a\,^4P)5p$	$y\,^3D^\circ$	1	*72760.7*	−190.0
		2	*72570.7*	615.0
		3	*73185.7*	
$4d^7(a\,^2G)5p$	$z\,^1G^\circ$	4	*72870.6*	
$4d^7(a\,^2H)5p$	$x\,^3G^\circ$	5	*73444.3*	−2060.2
		4	*76504.5*	−1090.5
		3	*77595.0*	
$4d^7(a\,^4P)5p$	$y\,^3P^\circ$	2	*73720.1*	−817.7
		1	*74537.8*	
		0		
$4d^7(a\,^2G)5p$	$z\,^1F^\circ$	3	*74364.4*	
$4d^7(a\,^2G)5p$	$y\,^3G^\circ$	5	*74509.8*	−469.6
		4	*74979.4*	−51.1
		3	*75030.5*	
$4d^7(a\,^2G)5p$	$z\,^1H^\circ$	5	*74836.2*	
$4d^7(a\,^2P)5p$	$x\,^3D^\circ$	3	*75691.1*	−875.5
		2	*76566.6*	−1066.4
		1	*77633.0*	
$4d^7(a\,^2H)5p$	$z\,^3I^\circ$	7	*75905.4?*	
		6		
		5	*76538.8*	
$4d^7(a\,^2D)5p$	$w\,^3D^\circ$	3	*76032.4*	25.1
		2	*76007.3*	−134.2
		1	*76141.5*	
$4d^7(a\,^2D)5p$	$x\,^3F^\circ$	4	*77842.8*	−1316.9
		3	*79159.7*	855.8
		2	*78303.9*	
$4d^7(a\,^2H)5p$	$z\,^1I^\circ$	6	*78297.6*	
$4d^7(a\,^2H)5p$	$y\,^3H^\circ$	6	*78735.4*	−663.9
		5	*79399.3*	−854.7
		4	*80254.0*	
$4d^7(a\,^4P)5p$	$y\,^3S^\circ$	1	*79044.2*	
$4d^7(a\,^2P)5p$	$z\,^1P^\circ$	1	*79547.6*	
$4d^7(a\,^2D)5p$	$z\,^1D^\circ$	2	*79717.5*	
$4d^7(a\,^2P)5p$	$y\,^1D^\circ$	2	*79938.8*	
$4d^7(a\,^2H)5p$	$y\,^1G^\circ$	4	*81488.5*	
$4d^7(a\,^2D)5p$	$y\,^1F^\circ$	3	*81788.9*	
$4d^7(a\,^2D)5p$	$x\,^3P^\circ$	2	*81955.0*	−1296.4
		1	*83251.4*	
		0		
$4d^7(a\,^2H)5p$	$y\,^1H^\circ$	5	*82830.7*	
$4d^7(a\,^2D)5p$	$y\,^1P^\circ$	1	*83176.2*	
$4d^7(a^2\,F)5p$	$v\,^3D^\circ$	3	*87394.0*	−536.1
		2	*87930.1?*	102.6
		1	*87827.5*	
Rh III ($^4F_{4\frac{1}{2}}$)	*Limit*	------	145800	

December 1956.

Rh II Observed Terms*

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6+$	Observed Terms									
$4d^8$	a ³P, a ¹D	a ³F	a ¹G							
	ns ($n \geq 5$)				np ($n \geq 5$)					
$4d^7(a\,^4F)ns$		a ⁵F b ³F					z ⁵D° z ³D°	z ⁵F° z ³F°	z ⁵G° z ³G°	
$4d^7(a\,^4P)ns$	a ⁵P c ³P				z ⁵S° y ³S°	z ⁵P° y ³P°	y ⁵D° y ³D°			
$4d^7(a\,^2G)ns$			a ³G b ¹G					y ³F° z ¹F°	y ³G° z ¹G°	z ³H° z ¹H°
$4d^7(a\,^2P)ns$	b ³P				z ³S°	x ³P° z ¹P°	x ³D° y ¹D°			
$4d^7(a\,^2H)ns$				a ³H a ¹H					x ³G° y ¹G°	y ³H° y ¹H°	z ³I° z ¹I°
$4d^7(a\,^2D)ns$	a ³D b ¹D					w ³P° y ¹P°	w ³D° z ¹D°	x ³F° y ¹F°		
$4d^7(a\,^2F)ns$							v ³D°			

*For predicted terms in the spectra of the Ru I isoelectronic sequence, see Volume III, Introduction.

Rh III

(Tc I sequence; 43 electrons) $Z=45$

$1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^7\;^4F_{4\frac{1}{2}}$

$a\,^4F_{4\frac{1}{2}}$ **250500 K** I. P. 31.05 volts

The analysis has been carried out by Catalán, Sales, and Shenstone especially for inclusion here. They have observed the spectrum from 687A to 4800 A, and classified 854 lines. Observed intersystem combinations connect the systems of terms having different multiplicity.

The limit has been interpolated by comparison of third spectra from Y to In, and furnished by Catalán and Rico in advance of publication.

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M. A. Catalán y F. R. Rico, An. Real Soc. Esp. Fisica y Quimica (Madrid) [A] **53**, 85 (1957). (I P)

Rh III

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$4d^7$	$a\,^4F$	4½	0.0		$4d^7$	$a\,^2H$	5½	19490.2	
		3½	2147.8	−2147.8			4½	21992.3	−2502.1
		2½	3485.7	−1337.9	$4d^7$	$a\,^2D$	2½	19528.5	
		1½	4322.0	−836.3			1½	22046.6	−2518.1
$4d^7$	$a\,^4P$	2½	11062.3		$4d^7$	$a\,^2F$	2½	31615.5	
		1½	10997.1	65.2			3½	32095.7	480.2
		0½	12469.8	−1472.7	$4d^6(^5D)5s$	$a\,^6D$	4½	43022.0	
$4d^7$	$a\,^2G$	4½	14044.0				3½	44394.4	−1372.4
		3½	15256.8	−1212.8			2½	45278.2	−883.8
$4d^7$	$a\,^2P$	1½	16870.7				1½	45876.6	−598.4
		0½	18303.7	−1433.0			0½	46227.1	−350.5

Rh III—Continued

Config.	Desig.	J	Level	Interval
$4d^7$	$b\,^2D$	1½	49183.4	1258.9
		2½	50442.3	
$4d^6(^5D)5s$	$a\,^4D$	3½	54632.2	−1493.5
		2½	56125.7	−886.8
		1½	57012.5	−518.8
		0½	57531.3	
$4d^6(^3P)5s$	$b\,^4P$	2½	62717.1	−3556.6
		1½	66273.7	−2519.4
		0½	68793.1	
$4d^6(^3H)5s$	$a\,^4H$	6½	64250.0	−632.8
		5½	64882.8	−335.1
		4½	65217.9	−265.7
		3½	65483.6	
$4d^6(^3F)5s$	$b\,^4F$	4½	66104.4	−580.2
		3½	66684.6	−341.1
		2½	67025.7	−451.1
		1½	67476.8	
$4d^6(^3G)5s$	$a\,^4G$	5½	70561.3	−1684.6
		4½	72245.9	−790.3
		3½	73036.2	−242.1
		2½	73278.3	
$4d^6(^3H)5s$	$b\,^2H$	5½	72580.2	−611.8
		4½	73192.0	
$4d^6(^3P)5s$	$b\,^2P$	1½	72837.7	−2071.9
		0½	74909.6	
$4d^6(^3F)5s$	$b\,^2F$	3½	76752.3	−956.3
		2½	77708.6	
$4d^6(^3G)5s$	$b\,^2G$	4½	79304.7	−1295.7
		3½	80600.4	
$4d^6(^3D)5s$	$b\,^4D$	0½	81589.5	124.1
		1½	81713.6	179.9
		2½	81893.5	263.0
		3½	82156.5	
$4d^6(^1I)5s$	$a\,^2I$	6½	82099.7	−314.8
		5½	82414.5	
$4d^6(^1G)5s$	$c\,^2G$	4½	83128.7	−238.6
		3½	83367.3	
$4d^6(^3D)5s$	$c\,^2D$	1½	86004.5	372.7
		2½	86377.2	
$4d^6(^1S)5s$	$a\,^2S$	0½	88151.0	
$4d^6(^1D)5s$	$d\,^2D$	2½	88248.7	−277.6
		1½	88526.3	
$4d^6(^5D)5p$	$z\,^6D^\circ$	4½	*91818.7*	−202.9
		3½	*92021.6*	−804.3
		2½	*92825.9*	−586.9
		1½	*93412.8*	−396.5
		0½	*93809.3*	
$4d^6(^5D)5p$	$z\,^6F^\circ$	5½	*97605.8*	38.5
		4½	*97567.3*	188.9
		3½	*97378.4*	−251.6
		2½	*97630.0*	−138.9
		1½	*97768.9*	−45.4
		0½	*97814.3*	
$4d^6(^1F)5s$	$c\,^2F$	3½	97867.8	−345.5
		2½	98213.3	
$4d^6(^5D)5p$	$z\,^6P^\circ$	3½	*99046.9*	−1894.9
		2½	*100941.8*	−1331.8
		1½	*102273.6*	
$4d^6(^5D)5p$	$z\,^4F^\circ$	4½	*100757.3*	−1689.5
		3½	*102446.8*	−867.1
		2½	*103313.9*	−666.3
		1½	*103980.2*	
$4d^6(^5D)5p$	$z\,^4D^\circ$	3½	*100845.9*	−1012.0
		2½	*101857.9*	−677.2
		1½	*102535.1*	−292.2
		0½	*102827.3*	
$4d^5(^4P)5s^2$	$c\,^4P$	0½	101445.1	445.7
		1½	101890.8	333.2
		2½	102224.0	
$4d^5(^4F)5s^2$	$c\,^4F$	1½	102194.2	8.0
		2½	102202.2	208.2
		3½	102410.4	57.6
		4½	102468.0	
$4d^6(^5D)5p$	$z\,^4P^\circ$	2½	*104183.4*	−1309.7
		1½	*105493.1*	−742.8
		0½	*106235.9*	
$4d^5(^2F)5s^2$	$d\,^2F$	2½	106665.1	344.3
		3½	107009.4	
$4d^5(^2P)5s^2$	$c\,^2P$	0½	106726.5	1086.5
		1½	107813.0	
$4d^5(^2G)5s^2$	$d\,^2G$	4½	111897.5	−1026.0
		3½	112923.5	
$4d^6(^3P)5p$	$z\,^4S^\circ$	1½	*112243.4*	
$4d^6(^3P)5p$	$y\,^4P^\circ$	2½	*112261.1*	−2671.9
		1½	*114933.0*	
		0½		
$4d^6(^3H)5p$	$z\,^4G^\circ$	5½	*113312.1*	−653.0
		4½	*113965.1*	−346.4
		3½	*114311.5*	−246.7
		2½	*114558.2*	
$4d^6(^3H)5p$	$z\,^4H^\circ$	6½	*113893.7*	−386.6
		5½	*114280.3*	−541.8
		4½	*114822.1*	−669.6
		3½	*115491.7*	
$4d^5(^2D)5s^2$	$e\,^2D$	2½	115013.2	−1090.8
		1½	116104.0	
$4d^6(^3H)5p$	$z\,^4I^\circ$	7½	*115590.0*	−619.0
		6½	*116209.0*	−135.0
		5½	*116344.0*	279.2
		4½	*116064.8*	
$4d^6(^3P)5p$	$y\,^4D^\circ$	3½	*115769.4*	−3942.9
		2½	*119712.3*	−856.1
		1½	*120568.4*	−290.3
		0½	*120858.7*	
$4d^6(^3P)5p$	$z\,^2D^\circ$	2½	*115991.6*	−2086.4
		1½	*118078.0*	
$4d^6(^3F)5p$	$y\,^4F^\circ$	1½	*116011.1*	311.7
		2½	*116322.8*	84.3
		3½	*116407.1*	457.1
		4½	*116864.4*	
$4d^6(^3H)5p$	$z\,^2G^\circ$	4½	*116295.7*	−669.3
		3½	*116965.0*	
$4d^6(^3F)5p$	$x\,^4D^\circ$	3½	*116990.8*	−1256.9
		2½	*118247.7*	−741.2
		1½	*118988.9*	−430.0
		0½	*119418.9*	
$4d^6(^3F)5p$	$y\,^4G^\circ$	5½	*117275.0*	−321.4
		4½	*117596.4*	−322.7
		3½	*117919.1*	−210.8
		2½	*118129.9*	
$4d^5(^2S)5s^2$	$b\,^2S$	0½	118210.2?	
$4d^6(^3H)5p$	$z\,^2I^\circ$	6½	*118277.6*	−675.8
		5½	*118953.4*	
$4d^6(^3F)5p$	$z\,^2F^\circ$	3½	*118850.2*	−631.0
		2½	*119481.2*	

Rh III—Continued

Config.	Desig.	J	Level	Interval
$4d^6(^3H)5p$	$z\ ^2H^\circ$	5½	*119734.0*	−1151.0
		4½	*120885.0*	
$4d^6(^3G)5p$	$z\ ^4G^\circ$	5½	*119841.7*	−211.0
		4½	*120052.7*	−1009.3
		3½	*121062.0*	−763.7
		2½	*121825.7*	
$4d^6(^3F)5p$	$y\ ^2G^\circ$	4½	*119998.0*	−908.6
		3½	*120906.6*	
$4d^6(^3P)5p$	$z\ ^2P^\circ$	1½	*120914.3*	−1697.1
		0½	*122611.4*	
$4d^6(^3G)5p$	$z\ ^4F^\circ$	4½	*122391.5*	−1005.9
		3½	*123397.4*	−463.4
		2½	*123860.8*	
		1½		
$4d^6(^3G)5p$	$y\ ^4H^\circ$	6½	*122993.9*	−239.3
		5½	*123233.2*	−129.8
		4½	*123363.0*	−44.3
		3½	*123407.3*	
$4d^6(^3F)5p$	$y\ ^2D^\circ$	2½	*124403.1*	−574.5
		1½	*124977.6*	
$4d^6(^3P)5p$	$z\ ^2S^\circ$	0½	*126265.2*	
$4d^6(^3G)5p$	$y\ ^2F^\circ$	2½	*126340.7*	906.1
		3½	*127246.8*	
$4d^6(^3D)5p$	$z\ ^4P^\circ$	0½	*126443.1*	380.4
		1½	*126823.5*	324.3
		2½	*127147.8*	
$4d^6(^3G)5p$	$y\ ^2H^\circ$	5½	*126530.9*	−1409.6
		4½	*127940.5*	
$4d^6(^3D)5p$	$w\ ^4D^\circ$	0½	*127885.2*	642.1
		1½	*128527.3*	286.2
		2½	*128813.5*	115.3
		3½	*128928.8*	
$4d^6(^3D)5p$	$w\ ^4F^\circ$	1½	*128906.4*	102.1
		2½	*129008.5*	117.7
		3½	*129126.2*	429.7
		4½	*129555.9*	
$4d^6(^1I)5p$	$z\ ^2K^\circ$	6½	*129141.0*	1464.2
		7½	*130605.2*	
$4d^6(^3G)5p$	$x\ ^2G^\circ$	4½	*129489.6*	−89.2
		3½	*129578.8*	
$4d^6(^1I)5p$	$x\ ^2H^\circ$	4½	*130406.4*	593.0
		5½	*130999.4*	
$4d^6(^1G)5p$	$w\ ^2G^\circ$	4½	*131817.4*	−188.7
		3½	*132006.1*	
$4d^6(^1G)5p$	$x\ ^2F^\circ$	3½	*132986.5*	−363.7
		2½	*133350.2*	
$4d^6(^3D)5p$	$y\ ^2P^\circ$	0½	*133088.8*	376.7
		1½	*133465.5*	
$4d^6(^1G)5p$	$w\ ^2H^\circ$	5½	*133911.[illegible]*	−398.5
		4½	*13[illegible]*	
$4d^6(^3D)5p$	$z\ ^2D^\circ$	1½	[illegible]	401.5
		2½	[illegible]	
$4d^6(^1I)5p$	$y\ ^2I^\circ$	6½	*1346[illegible]*	−668.4
		5½	*135363.1*	
$4d^6(^3D)5p$	$w\ ^2F^\circ$	3½	*135535.4*	−166.1
		2½	*135701.5*	
$4d^6(^1S)5p$	$x\ ^2P^\circ$	1½	*136124.8*	−304.8
		0½	*136429.6*	
$4d^6(^1D)5p$	$v\ ^2F^\circ$	2½	*137737.5*	481.0
		3½	*138218.5*	

Config.	Desig.	J	Level	Interval
$4d^6(^1D)5p$	$w\ ^2D^\circ$	1½	*138369.9*	268.9
		2½	*138638.8*	
$4d^6(^1D)5p$	$w\ ^2P^\circ$	0½	*139214.5*	544.5
		1½	*139759.0*	
$4d^6(^1F)5p$	$v\ ^2D^\circ$	2½	*143628.5*	−337.1
		1½	*143965.6*	
$4d^6(^1F)5p$	$v\ ^2G^\circ$	3½	*143835.6*	398.7
		4½	*144234.3*	
$4d^6(^1F)5p$	$u\ ^2F^\circ$	3½	*146546.0*	−535.3
		2½	*147081.3*	
$4d^6(^3P)5p'$	$w\ ^4P^\circ$	0½	*146577.2*	294.7
		1½	*146871.9*	753.3
		2½	*147625.2*	
$4d^6(^3P)5p'$	$v\ ^4D^\circ$	0½	*146939.1*	338.3
		1½	*147277.4*	464.2
		2½	*147741.6*	205.3
		3½	*147946.9*	
$4d^6(^3F)5p'$	$w\ ^4G^\circ$	2½	*148598.1*	225.2
		3½	*148823.3*	214.8
		4½	*149038.1*	249.7
		5½	*149287.8*	
$4d^6(^3P)5p'$	$y\ ^4S^\circ$	1½	*148734.3*	
$4d^6(^3F)5p'$	$u\ ^4D^\circ$	0½	*151845.6*	102.6
		1½	*151948.2*	479.7
		2½	*152427.9*	−59.4
		3½	*152368.5*	
$4d^6(^3F)5p'$	$u\ ^2D^\circ$	1½	*152556.4*	350.4
		2½	*152906.8*	
$4d^6(^5D)6s$	$e\ ^6D$	4½	152765.0?	
		3½		
		2½		
		1½		
		0½		
$4d^6(^3F)5p'$	$u\ ^2G^\circ$	4½	*152989.5*	−395.2
		3½	*153384.7*	
$4d^6(^3F)5p'$	$v\ ^4F^\circ$	1½	*153401.9*	96.0
		2½	*153497.9*	−4.4
		3½	*153493.5*	490.0
		4½	*153983.5*	
$4d^6(^3F)5p'$	$t\ ^2F^\circ$	2½	*154790.9*	555.0
		3½	*155345.9*	
$4d^6(^3P)5p'$	$t\ ^2D^\circ$	1½	*154913.7*	906.6
		2½	*155820.3*	
$4d^6(^3P)5p'$	$v\ ^2P^\circ$	0½	*158394.6*	344.4
		1½	*158739.0*	
$4d^6(^3P)5p'$	$y\ ^2S^\circ$	0½	*159182.6*	
$4d^6(^1G)5p'$	$s\ ^2F^\circ$	3½	*160593.7*	−556.7
		2½	*161150.4*	
$4d^6(^1G)5p'$	$t\ ^2G^\circ$	4½	*161846.4*	−1184.4
		3½	*163030.8*	
$4d^6(^1G)5p'$	$v\ ^2H^\circ$	5½	*164197.1*	−837.9
		4½	*165035.0*	
$4d^6(^1D)5p'$	$s\ ^2D^\circ$	2½	*166719.4*	−706.8
		1½	*167426.2*	
$4d^6(^1D)5p'$	$u\ ^2P^\circ$	1½	*167781.9*	−506.0
		0½	*168287.9*	
$4d^6(^1D)5p'$	$r\ ^2F^\circ$	3½	*167936.7*	−566.0
		2½	*168502.7*	
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Rh IV ($^5D_4$)	*Limit*	----	250500	

February 1957.

Rh III Observed Terms*

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6$ $3d^{10}\,4s^2\,4p^6+$	Observed Terms														
$4d^7$		$a\,^4\mathrm{P}$ $a\,^2\mathrm{P}$	$a\,^2\mathrm{D}$ $b\,^2\mathrm{D}$	$a\,^4\mathrm{F}$ $a\,^2\mathrm{F}$	$a\,^2\mathrm{G}$	$a\,^2\mathrm{H}$									
	$ns\ (n\geq 5)$							$np\ (n\geq 5)$							
$4d^6(^5\mathrm{D})nx$			$a,e\,^6\mathrm{D}$ $a\,^4\mathrm{D}$						$z\,^6\mathrm{P}^\circ$ $z\,^4\mathrm{P}^\circ$	$z\,^6\mathrm{D}^\circ$ $z\,^4\mathrm{D}^\circ$	$z\,^6\mathrm{F}^\circ$ $z\,^4\mathrm{F}^\circ$				
$4d^6(^3\mathrm{P})nx$		$b\,^4\mathrm{P}$ $b\,^2\mathrm{P}$						$z\,^4\mathrm{S}^\circ$ $z\,^2\mathrm{S}^\circ$	$y\,^4\mathrm{P}^\circ$ $z\,^2\mathrm{P}^\circ$	$y\,^4\mathrm{D}^\circ$ $z\,^2\mathrm{D}^\circ$					
$4d^6(^3\mathrm{H})nx$						$a\,^4\mathrm{H}$ $b\,^2\mathrm{H}$						$z\,^4\mathrm{G}^\circ$ $z\,^2\mathrm{G}^\circ$	$z\,^4\mathrm{H}^\circ$ $z\,^2\mathrm{H}^\circ$	$z\,^4\mathrm{I}^\circ$ $z\,^2\mathrm{I}^\circ$	
$4d^6(^3\mathrm{F})nx$				$b\,^4\mathrm{F}$ $b\,^2\mathrm{F}$						$x\,^4\mathrm{D}^\circ$ $y\,^2\mathrm{D}^\circ$	$y\,^4\mathrm{F}^\circ$ $z\,^2\mathrm{F}^\circ$	$y\,^4\mathrm{G}^\circ$ $y\,^2\mathrm{G}^\circ$			
$4d^6(^3\mathrm{G})nx$					$a\,^4\mathrm{G}$ $b\,^2\mathrm{G}$						$x\,^4\mathrm{F}^\circ$ $y\,^2\mathrm{F}^\circ$	$x\,^4\mathrm{G}^\circ$ $x\,^2\mathrm{G}^\circ$	$y\,^4\mathrm{H}^\circ$ $y\,^2\mathrm{H}^\circ$		
$4d^6(^3\mathrm{D})nx$			$b\,^4\mathrm{D}$ $c\,^2\mathrm{D}$						$x\,^4\mathrm{P}^\circ$ $y\,^2\mathrm{P}^\circ$	$w\,^4\mathrm{D}^\circ$ $x\,^2\mathrm{D}^\circ$	$w\,^4\mathrm{F}^\circ$ $w\,^2\mathrm{F}^\circ$				
$4d^6(^1\mathrm{I})nx$							$a\,^2\mathrm{I}$						$x\,^2\mathrm{H}^\circ$	$y\,^2\mathrm{I}^\circ$	$z\,^2\mathrm{K}^\circ$
$4d^6(^1\mathrm{G})nx$					$c\,^2\mathrm{G}$						$x\,^2\mathrm{F}^\circ$	$w\,^2\mathrm{G}^\circ$	$w\,^2\mathrm{H}^\circ$		
$4d^6(^1\mathrm{S})nx$	$a\,^2\mathrm{S}$								$x\,^2\mathrm{P}^\circ$						
$4d^6(^1\mathrm{D})nx$			$d\,^2\mathrm{D}$						$w\,^2\mathrm{P}^\circ$	$w\,^2\mathrm{D}^\circ$	$v\,^2\mathrm{F}^\circ$				
$4d^6(^1\mathrm{F})nx$				$c\,^2\mathrm{F}$						$v\,^2\mathrm{D}^\circ$	$u\,^2\mathrm{F}^\circ$	$v\,^2\mathrm{G}^\circ$			
$4d^6(^3\mathrm{P})nx$[†]		$c\,^4\mathrm{P}$ $c\,^2\mathrm{P}$						$y\,^4\mathrm{S}^\circ$ $y\,^2\mathrm{S}^\circ$	$w\,^4\mathrm{P}^\circ$ $v\,^2\mathrm{P}^\circ$	$v\,^4\mathrm{D}^\circ$ $t\,^2\mathrm{D}^\circ$					
$4d^6(^3\mathrm{F})nx$[†]				$c\,^4\mathrm{F}$ $d\,^2\mathrm{F}$						$u\,^4\mathrm{D}^\circ$ $u\,^2\mathrm{D}^\circ$	$v\,^4\mathrm{F}^\circ$ $t\,^2\mathrm{F}^\circ$	$w\,^4\mathrm{G}^\circ$ $u\,^2\mathrm{G}^\circ$			
$4d^6(^1\mathrm{G})nx$[†]					$d\,^2\mathrm{G}$						$s\,^2\mathrm{F}^\circ$	$t\,^2\mathrm{G}^\circ$	$v\,^2\mathrm{H}^\circ$		
$4d^6(^1\mathrm{D})nx$[†]			$e\,^2\mathrm{D}$						$u\,^2\mathrm{P}^\circ$	$s\,^2\mathrm{D}^\circ$	$r\,^2\mathrm{F}^\circ$				
$4d^6(^1\mathrm{S})nx$[†]	$b\,^2\mathrm{S}$														

*For predicted terms in the spectra of the Tc I isoelectronic sequence, see Vol. III, Introduction.
[†]This entry refers to the higher limit term of the given type, for this configuration.

PALLADIUM

Pd I

46 electrons **$Z=46$**

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\;{}^1S_0$

$4d^{10}\;{}^1S_0$ 67236.0 K **I. P. 8.33 volts**

The analysis is from Shenstone, who, in 1930, revised and extended the earlier work by McLennan and Smith, Bechert and Catalán, Meggers and Laporte, and others. With the aid of recent ultraviolet observations he has carried it still further, and furnished the additional levels especially for inclusion here. There are 390 classified lines between 1723.65 A and 9234.02 A. In the 1930 term table he gives observed g-values based on all available material. More recent Zeeman data from the Massachusetts Institute of Technology have been published by Lindsley and Rosen, who also derived more accurate values for some of the energy levels. In the table, the two-place entries for energy levels are from their paper. The first column in the table (labeled "S") gives Shenstone's notation.

In his 1953 paper, Shenstone discusses forbidden transitions in the Pd I spectrum. He explains the level previously called K_1 (*54825.7*), as resulting from "forced" dipole radiation.

The singlet and triplet systems of terms are connected by observed intersystem combinations.

Mack has noted that the sequence Pd I—Sn V shows a gradual transition from *LS*- to *jj*-coupling for levels from the $d^9\,s$ and $d^9\,p$ configurations. By analogy with Cu II, the writer has prepared the following table giving the *Jl*-coupling notation in the form suggested by Racah.

Author	Config.	Desig.	J	Author	Config.	Desig.	J
$ns\;{}^3D_3$ ${}^3D_2$	$4d^9({}^2D_{2\frac{1}{2}})ns$	$ns\;[2\frac{1}{2}]$	3 2	$nd\;{}^3S_1$	$4d^9({}^2D_{2\frac{1}{2}})nd$	$nd\;[0\frac{1}{2}]$	1
$ns\;{}^3D_1$ ${}^1D_2$	$4d^9({}^2D_{1\frac{1}{2}})ns$	$ns'\;[1\frac{1}{2}]$	1 2	$nd\;{}^3G_5$ ${}^3G_4$	"	$nd\;[4\frac{1}{2}]$	5 4
				$nd\;{}^3P_2$ ${}^3P_1$	"	$nd\;[1\frac{1}{2}]$	2 1
$np\;{}^3P^\circ_2$ ${}^3P^\circ_1$	$4d^9({}^2D_{2\frac{1}{2}})np$	$np\;[1\frac{1}{2}]^\circ$	2 1	$nd\;{}^3D_3$ ${}^3D_2$	"	$nd\;[2\frac{1}{2}]$	3 2
$np\;{}^3F^\circ_3$ ${}^3F^\circ_4$	"	$np\;[3\frac{1}{2}]^\circ$	3 4	$nd\;{}^3F_3$ ${}^3F_4$	"	$nd\;[3\frac{1}{2}]$	3 4
$np\;{}^3D^\circ_3$ ${}^3D^\circ_2$	"	$np\;[2\frac{1}{2}]^\circ$	3 2	$nd\;{}^3P_0$	"	$nd\;[0\frac{1}{2}]$	0
$np\;{}^3P^\circ_0$ ${}^1P^\circ_1$	$4d^9({}^2D_{1\frac{1}{2}})np$	$np'\;[0\frac{1}{2}]^\circ$	0 1	$nd\;{}^1P_1$	$4d^9({}^2D_{1\frac{1}{2}})nd$	$nd'\;[0\frac{1}{2}]$	1
$np\;{}^3F^\circ_2$ ${}^1F^\circ_3$	"	$np'\;[2\frac{1}{2}]^\circ$	2 3	$nd\;{}^3G_3$ ${}^1G_4$	"	$nd'\;[3\frac{1}{2}]$	3 4
$np\;{}^3D^\circ_1$ ${}^1D^\circ_2$	"	$np'\;[1\frac{1}{2}]^\circ$	1 2	$nd\;{}^3D_1$ ${}^1D_2$	"	$nd'\;[1\frac{1}{2}]$	1 2
				$nd\;{}^3F_2$ ${}^1F_3$	"	$nd'\;[2\frac{1}{2}]$	2 3
				$nd\;{}^1S_0$	"	$nd'\;[0\frac{1}{2}]$	0

Pd I—Continued

Shenstone has derived the limits from the $ns\ ^3D$, $ns\ ^1D$ series ($n=6$ to 8), by means of a Ritz formula; and lists in his term table the Rydberg denominators for many of the levels.

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Pd I

S	Config.	Desig.	J	Level	Interval	Obs. g
$a\ ^1S_0$	$4d^{10}$	$4d^{10}\ ^1S$	0	0.00		0/0
$5s\ ^3D_3$	$4d^9(^2D_{2\frac{1}{2}})5s$	$5s\ ^3D$	3	6564.11	−1190.88	1.333
$5s\ ^3D_2$	"		2	7754.99	−2338.95	1.128
$5s\ ^3D_1$	$4d^9(^2D_{1\frac{1}{2}})5s$		1	10093.94		0.497
$5s\ ^1D_2$	$4d(^2D_{1\frac{1}{2}})5s$	$5s\ ^1D$	2	11721.77		1.040
$a\ ^3F_4$	$4d^8\ 5s^2$	$5s^2\ ^3F$	4	25101.1	−3112.4	
$a\ ^3F_3$			3	28213.5	−1497.5	
$a\ ^3F_2$			2	29711.0		
$5p\ ^3P^\circ_2$	$4d^9(^2D_{2\frac{1}{2}})5p$	$5p\ ^3P^\circ$	2	*34068.93*	−2111.71	1.482
$5p\ ^3P^\circ_1$	"		1	*36180.64*	−1907.47	1.396
$5p\ ^3P^\circ_0$	$4d^9(^2D_{1\frac{1}{2}})5p$		0	*38088.11*		0/0
$5p\ ^3F^\circ_4$	$4d^9(^2D_{2\frac{1}{2}})5p$	$5p\ ^3F^\circ$	4	*35927.89*	476.49	1.25
$5p\ ^3F^\circ_3$	"		3	*35451.40*	−3360.46	1.063
$5p\ ^3F^\circ_2$	$4d^9(^2D_{1\frac{1}{2}})5p$		2	*38811.86*		0.752
$5p\ ^3D^\circ_3$	$4d^9(^2D_{2\frac{1}{2}})5p$	$5p\ ^3D^\circ$	3	*37393.71*	417.78	1.276
$5p\ ^3D^\circ_2$	"		2	*36975.93*	−3392.80	0.988
$5p\ ^3D^\circ_1$	$4d^9(^2D_{1\frac{1}{2}})5p$		1	*40368.73*		0.831
$5p\ ^1F^\circ_3$	$4d^9(^2D_{1\frac{1}{2}})5p$	$5p\ ^1F^\circ$	3	*39858.33*		1.081
$5p\ ^1D^\circ_2$	$4d^9(^2D_{1\frac{1}{2}})5p$	$5p\ ^1D^\circ$	2	*40771.46*		1.114
$5p\ ^1P^\circ_1$	$4d^9(^2D_{1\frac{1}{2}})5p$	$5p\ ^1P^\circ$	1	*40838.80*		0.768
$6s\ ^3D_3$	$4d^9(^2D_{2\frac{1}{2}})6s$	$6s\ ^3D$	3	48804.2	−215.3	
$6s\ ^3D_2$	"		2	49019.5	−3316.8	
$6s\ ^3D_1$	$4d^9(^2D_{1\frac{1}{2}})6s$		1	52336.3		
5°_3	$4d^8\ 5s(\ \ )5p$		3	*50910.4*		1.47?
1°_3	$4d^8\ 5s(\ \ )5p$		3	*52457.0*		1.26?
$6s\ ^1D_2$	$4d^9(^2D_{1\frac{1}{2}})6s$	$6s\ ^1D$	2	52487.7		
$6p\ ^3P^\circ_2$	$4d^9(^2D_{2\frac{1}{2}})6p$	$6p\ ^3P^\circ$	2	*53039.0?*	−1786.7	
$6p\ ^3P^\circ_1$	"		1	*54825.7*		
			0			
$6p\ ^3F^\circ_4$	$4d^9(^2D_{2\frac{1}{2}})6p$	$6p\ ^3F^\circ$	4	*54335.9*	574.3	
$6p\ ^3F^\circ_3$	"		3	*53761.6*	−4164.2	
$6p\ ^3F^\circ_2$	$4d^9(^2D_{1\frac{1}{2}})6p$		2	*57925.8*		
$5d\ ^3S_1$	$4d^9(^2D_{2\frac{1}{2}})5d$	$5d\ ^3S$	1	54574.1		
$6p\ ^3D^\circ_3$	$4d^9(^2D_{2\frac{1}{2}})6p$	$6p\ ^3D^\circ$	3	*54599.5*	424.8	
$6p\ ^3D^\circ_2$	"		2	*54174.7*	−3842.0	
$6p\ ^3D^\circ_1$	$4d^9(^2D_{1\frac{1}{2}})6p$		1	*58016.7*		
4°_3	$4d^8\ 5s(\ \ )5p$	4°	3	*54673.0*		1.29?
$5d\ ^3G_5$	$4d^9(^2D_{2\frac{1}{2}})5d$	$5d\ ^3G$	5	54806.1	−5.2	
$5d\ ^3G_4$	"		4	54811.3	−3537.6	
$5d\ ^3G_3$	$4d^9(^2D_{1\frac{1}{2}})5d$		3	58348.9		

Pd I

S	Config.	Desig.	J	Level	Interval	Obs. g
$5d\ ^3P_2$	$4d^9(^2D_{2\frac{1}{2}})5d$	$5d\ ^3P$	2	54820.6	−2.1	
$5d\ ^3P_1$	"		1	54822.7	−550.3	
$5d\ ^3P_0$	"		0	55373.0		
$5d\ ^3D_3$	$4d^9(^2D_{2\frac{1}{2}})5d$	$5d\ ^3D$	3	54947.7	−50.8	
$5d\ ^3D_2$	"		2	54998.5	−3409.6	
$5d\ ^3D_1$	$4d^9(^2D_{1\frac{1}{2}})5d$		1	58408.1		
$5d\ ^3F_4$	$4d^9(^2D_{2\frac{1}{2}})5d$	$5d\ ^3F$	4	55025.2	13.0	
$5d\ ^3F_3$	"		3	55012.2	−3543.6	
$5d\ ^3F_2$	$4d^9(^2D_{1\frac{1}{2}})5d$		2	58555.8		
6°_3	$4d^8\ 5s(\ \ )5p$		2, 3	*55633.7*		0.92?
7°	$4d^8\ 5s(\ \ )5p$		2?	*56335.6?*		
$8^\circ_{3,4}$	$4d^8\ 5s(\ \ )5p$		3, 4	*56544.3*		1.06
20°_1	$4d^8\ 5s(\ \ )5p$		1	*56645.8*		
$21^\circ_{3,4}$	$4d^8\ 5s(\ \ )5p$		3, 4	*56911.1*		1.33
$22^\circ_{1,2}$	$4d^8\ 5s(\ \ )5p$		1, 2	*57136.8?*		
9°_3	$4d^8\ 5s(\ \ )5p$		3	*57254.8*		
10°_2	$4d^8\ 5s(\ \ )5p$		2	*57564.8*		
$7s\ ^3D_3$	$4d^9(^2D_{2\frac{1}{2}})7s$	$7s\ ^3D$	3	58064.1	−74.2	
$7s\ ^3D_2$	"		2	58138.3	−3464.5	
$7s\ ^3D_1$	$4d^9(^2D_{1\frac{1}{2}})7s$		1	61602.8		
$12^\circ_{1,2}$	$4d^8\ 5s(\ \ )5p$		2	*58102.7?*		
23°_3	$4d^8\ 5s(\ \ )5p$		3	*58108.2*		
$5d\ ^1P_1$	$4d^9(^2D_{1\frac{1}{2}})5d$	$5d\ ^1P$	1	58195.3		
$24^\circ_{3,4}$	$4d^8\ 5s(\ \ )5p$		3, 4	*58316.6*		1.25
$5d\ ^1G_4$	$4d^9(^2D_{1\frac{1}{2}})5d$	$5d\ ^1G$	4	58387.8		
$6p\ ^1F^\circ_3$	$4d^9(^2D_{1\frac{1}{2}})6p$	$6p\ ^1F^\circ$	3	*58389.8*		
14°_2	$4d^8\ 5s(\ \ )5p$		2	*58415.2*		0.91?
$5d\ ^1D_2$	$4d^9(^2D_{1\frac{1}{2}})5d$	$5d\ ^1D$	2	58448.5		
$5d\ ^1F_3$	$4d^9(^2D_{1\frac{1}{2}})5d$	$5d\ ^1F$	3	58561.7		
$5d\ ^1S_0$	$4d^9(^2D_{1\frac{1}{2}})5d$	$5d\ ^1S$	0	58681.3		
15°_3	$4d^8\ 5s(\ \ )5p$		3	*59142.2*		1.04?
$16^\circ_{1,2}$	$4d^8\ 5s(\ \ )5p$		1, 2	*59587.8*		
17°_2	$4d^8\ 5s(\ \ )5p$		2	*59730.9*		
25°_3	$4d^8\ 5s(\ \ )5p$		3	*59864.5*		

Pd I—Continued

S	Config.	Desig.	J	Level	Interval	Obs. g
26°_2	$4d^8\,5s(\ )5p$		2	*60069.5*		
27°_2	$4d^8\,5s(\ )5p$		2	*60084.4*		
$6d\ ^3S_1$	$4d^9(^2D_{2\frac{1}{2}})6d$	$6d\ ^3S$	1	60225.8		
$28^\circ_{3,4}$	$4d^8\,5s(\ )5p$		3, 4	*60310.3*		
$6d\ ^3G_5$	$4d^9(^2D_{2\frac{1}{2}})6d$	$6d\ ^3G$	5	60316.4		
$6d\ ^3G_4$	″		4	60318.4	−2.0	
$6d\ ^3G_3$	$4d^9(^2D_{1\frac{1}{2}})6d$		3	63853.0	−3534.6	
30°	$4d^8(\quad)4f?$			*60317.1?*		
$6d\ ^3P_2$	$4d^9(^2D_{2\frac{1}{2}})6d$	$6d\ ^3P$	2	60322.8		
	″		1	60324.6		
			0			
$6d\ ^3D_3$	$4d^9(^2D_{2\frac{1}{2}})6d$	$6d\ ^3D$	3	60370.4		
$6d\ ^3D_2$	″		2	60396.4	−26.0	
$6d\ ^3D_1$	$4d^9(^2D_{1\frac{1}{2}})6d$		1	63896.3	−3499.9	
$6d\ ^3F_4$	$4d^9(^2D_{2\frac{1}{2}})6d$	$6d\ ^3F$	4	60404.0		
$6d\ ^3F_3$	″		3	60397.9	6.1	
$6d\ ^3F_2$	$4d^9(^2D_{1\frac{1}{2}})6d$		2	63937.4	−3539.5	
29°_2	$4d^8\,5s(\ )5p$		2	*60655.2*		
$z\ ^1G^\circ_4$	$4d^8\,5s(^2F)5p$	$5p'\ ^1G^\circ$	4	*60722.7*		1.20?
$18^\circ_{1,2}$	$4d^8\,5s(\ )5p$		1, 2	*60729.5*		
$7s\ ^1D_2$	$4d^9(^2D_{1\frac{1}{2}})7s$	$7s\ ^1D$	2	61638.6		
$8s\ ^3D_3$	$4d^9(^2D_{2\frac{1}{2}})8s$	$8s\ ^3D$	3	61736.2		
			2			
			1			
$z\ ^1F^\circ_3$	$4d^8\,5s(^2F)5p$	$5p'\ ^1F^\circ$	3	*62316.2*		1.06
$z\ ^1D^\circ_2$	$4d^8\,5s(^2F)5p$	$5p'\ ^1D^\circ$	2	*62596.2*		
31°	$4d^8\,5s(\ )5p$		2?	*63094.4?*		
32°_3	$4d^8\,5s(\ )5p$		3	*63476.4*		
$33^\circ_{1,2}$	$4d^8\,5s(\ )5p$		1, 2	*63568.8?*		
$9s\ ^3D_3$	$4d^9(^2D_{2\frac{1}{2}})9s$	$9s\ ^3D$	3	63571.7?		
			2			
			1			
$6d\ ^1G_4$	$4d^9(^2D_{1\frac{1}{2}})6d$	$6d\ ^1G$	4	63872.7		
$6d\ ^1F_3$	$4d^9(^2D_{1\frac{1}{2}})6d$	$6d\ ^1F$	3	63939.8		
$34^\circ_{1,2}$	$4d^8\,5s(\ )5p$		1, 2	*63961.5?*		
$35^\circ_{1,2}$	$4d^8\,5s(\ )5p$		1, 2	*64966.0?*		
	Pd II $(^2D_{2\frac{1}{2}})$	*Limit*	...	67236.0		
	Pd II $(^2D_{1\frac{1}{2}})$	*Limit*	...	70775.0		

February 1955.

Pd I Observed Terms*

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6+$	Observed Terms		
$4d^{10}$	$4d^{10}\ ^1S$		
$4d^8\,5s^2$	$5s^2\ ^3F$		
	$ns\ (n\geq5)$	$np\ (n\geq5)$	
$4d^9(^2D)nx$	{5–9s ^3D; 5–7s ^1D	5, 6p $^3P^\circ$ 5, 6p $^3D^\circ$ 5, 6p $^3F^\circ$; 5p $^1P^\circ$ 5p $^1D^\circ$ 5, 6p $^1F^\circ$	
$4d^8\,5s(^2F)nx'$		5p′ $^1D^\circ$ 5p′ $^1F^\circ$ 5p′ $^1G^\circ$	
	$nd\ (n\geq5)$		
$4d^9(^2D)nx$	{5, 6d ^3S 5, 6d ^3P 5, 6d ^3D 5, 6d ^3F 5, 6d ^3G; 5d ^1S 5d ^1P 5d ^1D 5, 6d ^1F 5, 6d ^1G		

*For predicted terms in the spectra of the Pd I isoelectronic sequence, see Vol. III, Introduction.

Pd II

(Rh I sequence; 45 electrons) $Z=46$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^9\ {}^2D_{2\frac{1}{2}}$

$4d^9\ {}^2D_{2\frac{1}{2}}$ 156700 K I. P. 19.42 volts

In 1928 Shenstone revised and extended the earlier work on this spectrum, and published 356 classified lines in the interval 1115.16 A to 4156.95 A. This list is from observations by himself and others. Those in the vacuum region are by H. E. White, who located the ground term.

Blair used a Schüler tube to observe the spectrum more completely, in order to extend the analysis of terms from the $4d^8\,6s$ and $4d^8\,5d$ configurations. His list covers the range from 2124.33 A to 3382.57 A, and includes 257 classified lines. About 60 lines are common to both published lists. Blair improved the values of eleven higher levels given by Shenstone, and added 35 new levels. He revised the levels at 112872.7 K and 114940.2 K, designated by Shenstone $5d\ {}^4G_5$ and $6s\ {}^4P_3$, respectively, retaining the latter level as a miscellaneous one labeled $sd\ 3_{2\frac{1}{2}}$, and rejecting the former one.

The g-values in the table are from the 1941 paper with the exception of four entries for high levels, which are from Shenstone. Three place g-values are, in general, from resolved patterns observed at the Massachusetts Institute of Technology.

Shenstone determined the approximate limit 160605 K from the $5,6s\ {}^4F$ series. This was recently revised by Catalán and Rico from a study of the series in second spectra from Sr II to Cd II. The revised value is quoted here. Blair comments that the ${}^4F_{4\frac{1}{2}}$, ${}^4F_{3\frac{1}{2}}$ levels "appear to be approaching the same limit as would be expected with the inverted type of convergence pointed out by Shenstone . . .." This type of convergence is discussed under Ni I in the present volumes.

Observed intersystem combinations connect the doublet and quartet systems of terms.

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Pd II

Authors	Config.	Desig.	J	Level	Interval	Obs. g
4d $^2D_3$	$4d^9$	$4d^9$ ^2D	2½	0	−3539	
4d $^2D_2$			1½	3539		
5s $^4F_5$	$4d^8(^3F)5s$	5s ^4F	4½	25081. 0	−2013. 3	1. 330
5s $^4F_4$			3½	27094. 3	−1832. 7	1. 248
5s $^4F_3$			2½	28927. 0	−1018. 6	1. 031
5s $^4F_2$			1½	29945. 6		0. 424
5s $^2F_4$	$4d^8(^3F)5s$	5s ^2F	3½	32277. 9	−2144. 1	1. 148
5s $^2F_3$			2½	34422. 0		1. 096
5s $^4P_3$	$4d^8(^3P)5s$	5s′ ^4P	2½	36281. 5	−1083. 5	1. 323
5s $^4P_2$			1½	37365. 0	−1137. 4	1. 462
5s $^4P_1$			0½	38502. 4		2. 666
5s $^2D_2$	$4d^8(^1D)5s$	5s″ ^2D	1½	39571. 1	1627. 2	1. 165
5s $^2D_3$			2½	41198. 3		1. 239
5s $^2P_2$	$4d^8(^3P)5s$	5s′ ^2P	1½	43647. 8	−292. 0	1. 220
5s $^2P_1$			0½	43939. 8		0. 681
5s $^2G_5$	$4d^8(^1G)5s$	5s‴ ^2G	4½	44505. 7	−108. 2	1. 099
5s $^2G_4$			3½	44613. 9		0. 886
ap $^4D_4$	$4d^8(^3F)5p$	5p $^4D°$	3½	*65247. 0*	−2715. 2	1. 40
ap $^4D_3$			2½	*67962. 2*	−2157. 6	1. 328
ap $^4D_2$			1½	*70119. 8*	−1059. 1	1. 168
ap $^4D_1$			0½	*71178. 9*		0. 038
ap $^4G_6$	$4d^8(^3F)5p$	5p $^4G°$	5½	*68611. 5*	1312. 5	1. 28
ap $^4G_5$			4½	*67299. 0*	−2311. 2	1. 17
ap $^4G_4$			3½	*69610. 2*	−1459. 3	1. 069
ap $^4G_3$			2½	*71069. 5*		0. 718
ap $^4F_5$	$4d^8(^3F)5p$	5p $^4F°$	4½	*69878. 4*	−1366. 3	1. 28
ap $^4F_4$			3½	*71244. 7*	−1867. 7	1. 11
ap $^4F_3$			2½	*73112. 4*	764. 4	1. 047
ap $^4F_2$			1½	*72348. 0*		0. 724
ap $^2G_5$	$4d^8(^3F)5p$	5p $^2G°$	4½	*72285. 0*	−2033. 7	1. 15
ap $^2G_4$			3½	*74318. 7*		0. 99
ap $^2D_3$	$4d^8(^3F)5p$	5p $^2D°$	2½	*72732. 6*	−2365. 4	1. 020
ap $^2D_2$			1½	*75098. 0*		0. 920
ap $^2F_4$	$4d^8(^3F)5p$	5p $^2F°$	3½	*73327. 5*	−2426. 1	1. 09
ap $^2F_3$			2½	*75753. 6*		1. 115
bp $^4P_3$	$4d^8(^3P)5p$	5p′ $^4P°$	2½	*76767. 4*	12. 9	1. 34
bp $^4P_2$			1½	*76754. 5*	−52. 9	1. 317
bp $^4P_1$			0½	*76807. 4*		2. 266
cp $^2F_3$	$4d^8(^1D)5p$	5p″ $^2F°$	2½	*78765. 3*	942. 7	1. 056
cp $^2F_4$			3½	*79708. 0*		1. 25
cp $^2P_1$	$4d^8(^1D)5p$	5p″ $^2P°$	0½	*79612. 4*	1343. 7	1. 09
cp $^2P_2$			1½	*80956. 1*		1. 130
cp $^2D_2$	$4d^8(^1D)5p$	5p″ $^2D°$	1½	*81557. 2*	499. 8	1. 186
cp $^2D_3$			2½	*82057. 0*		1. 20

Pd II

Authors	Config.	Desig.	J	Level	Interval	Obs. g
bp $^4D_1$	$4d^8(^3P)5p$	5p′ $^4D°$	0½	*81805. 0*	528. 7	0. 049
bp $^4D_2$			1½	*82333. 7*	116. 3	1. 17
bp $^4D_3$			2½	*82450. 0*	606. 3	1. 233
bp $^4D_4$			3½	*83056. 3*		1. 22
kp $^2H_5$	$4d^8(^1G)5p$	5p‴ $^2H°$	4½	*83789. 7*	1803. 2	0. 91
kp $^2H_6$			5½	*85592. 9*		1. 09
ep $^2D_3$	$4d^8(^3P)5p$	5p′ $^2D°$	2½	*83802. 5*	−569. 8	1. 19
ep $^2D_2$			1½	*84372. 3*		0. 834
ep $^2S_1$	$4d^8(^3P)5p$	5p′ $^2S°$	0½	*85070. 7*		1. 839
ep $^2P_2$	$4d^8(^3P)5p$	5p′ $^2P°$	1½	*85151. 0*	−2887. 1	1. 411
ep $^2P_1$			0½	*88038. 1*		0. 70
kp $^2F_4$	$4d^8(^1G)5p$	5p‴ $^2F°$	3½	*86043. 1*	−1077. 3	1. 09
kp $^2F_3$			2½	*87120. 4*		0. 92?
bp $^4S_2$	$4d^8(^3P)5p$	5p′ $^4S°$	1½	*86279. 6*		2. 00
kp $^2G_4$	$4d^8(^1G)5p$	5p‴ $^2G°$	3½	*89682. 5*	299. 9	0. 89
kp $^2G_5$			4½	*89982. 4*		1. 11
6s $^4F_5$	$4d^8(^3F)6s$	6s ^4F	4½	104616. 0	−692. 2	
6s $^4F_4$			3½	105308. 2	−2838. 8	
6s $^4F_3$			2½	108147. 0	−1183. 0	
6s $^4F_2$			1½	109330. 0		
6s $^2F_4$	$4d^8(^3F)6s$	6s ^2F	3½	108146. 0	−1782. 5	
6s $^2F_3$			2½	109928. 5		
5d $^4D_{3½}$	$4d^8(^3F)5d$	5d ^4D	3½	110204. 5	—617. 4	
ed $^4D_{2½}$			2½	110821. 9		
			1½			
			0½			
5d $^4F_{4½}$	$4d^8(^3F)5d$	5d ^4F	4½	110886. 6	−203. 7	
5d $^4F_{3½}$			3½	111090. 3	−3137. 9	
ed $^4F_{2½}$			2½	114228. 2	−1221. 5	
ed $^4F_{1½}$			1½	115449. 7		
ed $^4G_{5½}$	$4d^8(^3F)5d$	5d ^4G	5½	110910. 3	−336. 7	
ed $^4G_{4½}$			4½	111247. 0	−2588. 7	
ed $^4G_{3½}$			3½	113835. 7		
			2½			
ed $^4H_{6½}$	$4d^8(^3F)5d$	5d ^4H	6½	110986. 8	362. 3	
ed $^4H_{5½}$			5½	110624. 5		
			4½			
			3½			
$1_{3½}$			3½	114001. 4		
ed $^2F_{3½}$?	$4d^8(^3F)5d$	5d ^2F?	3½	114241. 0		
			2½			
ed $2_{2½}$	$4d^8(^3F)5d$		2½	114647. 6		
ed $3_{2½}$	$4d^8(^3F)5d$		2½	114940. 2		
ed $4_{½}$	$4d^8(^3F)5d$		0½	115426. 9		

Pd II—Continued

Authors	Config.	Desig.	J	Level	Interval	Obs. g
ed $5_{3\frac{1}{2}}$	$4d^8(^3F)5d$		3½	115551. 5		
ed $6_{3\frac{1}{2}}$	$4d^8(^3F)5d$		3½	115771. 2		
6s $^4P_{2\frac{1}{2}}$ 6s $^4P_{1\frac{1}{2}}$? 6s $^4P_{\frac{1}{2}}$	$4d^8(^3P)6s$	$6s'$ ^4P	2½ 1½ 0½	116511. 6 118144. 6 118918. 4	−1633. 0 −773. 8	
ed $7_{2\frac{1}{2}}$	$4d^8(^3F)5d$		2½	117149. 7		
ed $8_{1\frac{1}{2}}$	$4d^8(^3F)5d$		1½	117332. 1		
ed $9_{2\frac{1}{2}}$	$4d^8(^3F)5d$		2½	118648. 5		
6s $^2D_{1\frac{1}{2}}$ 6s $^2D_{2\frac{1}{2}}$	$4d^8(^1D)6s$	$6s''$ ^2D	1½ 2½	118781. 7 119394. 6	612. 9	
6s $^2P_{\frac{1}{2}}$? 6s $^2P_{1\frac{1}{2}}$	$4d^8(^3P)6s$	$6s'$ ^2P	0½ 1½	119080. 6 119743. 6	663. 0	
6s $^2G_{4\frac{1}{2}}$ 6s $^2G_{3\frac{1}{2}}$	$4d^8(^1G)6s$	$6s'''$ ^2G	4½ 3½	122706. 0 122718. 5	−12. 5	
fd $10_{1\frac{1}{2}}$	$4d^8(^1D)5d$		1½	123755. 0		
fd $11_{1\frac{1}{2}}$	$4d^8(^1D)5d$		1½	123866. 1		
fd $12_{2\frac{1}{2}}$	$4d^8(^1D)5d$		2½	124149. 6		
fd $13_{2\frac{1}{2}}$	$4d^8(^1D)5d$		2½	124280. 3		
fd 14	$4d^8(^1D)5d$			124930. 0		
gd ^2D	$4d^8(^1G)5d$	$5d'''$ ^2D	2½ 1½	12[illegible]5. 2		
gd $^2F_{3\frac{1}{2}}$ gd $^2F_{2\frac{1}{2}}$	$4d^8(^1G)5d$	$5d'''$ ^2F	3½ 2½	128623. 6 128664. 5	−40. 9	
gd $^2G_{4\frac{1}{2}}$ gd $^2G_{3\frac{1}{2}}$	$4d^8(^1G)5d$	$5d'''$ ^2G	4½ 3½	129309. 3 129382. 5	−73. 2	
	Pd III ($^3F_4$)	*Limit*	----	156700		

December 1956.

Pd II Observed Terms*

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6+$	Observed Terms		
$4d^9$	$4d^9$ ^2D		
	ns $(n \geq 5)$	np $(n \geq 5)$	nd $(n \geq 5)$
$4d^8(^3F)nx$	5, 6s ^4F 5, 6s ^2F	5p $^4D°$ 5p $^4F°$ 5p $^4G°$ 5p $^2D°$ 5p $^2F°$ 5p $^2G°$	5d ^4D 5d ^4F 5d ^4G 5d ^4H 5d ^2F?
$4d^8(^3P)nx'$	5, 6s′ ^4P 5, 6s′ ^2P	5p′ $^4S°$ 5p′ $^4P°$ 5p′ $^4D°$ 5p′ $^2S°$ 5p′ $^2P°$ 5p′ $^2D°$	
$4d^8(^1D)nx''$	5, 6s″ ^2D	5p″ $^2P°$ 5p″ $^2D°$ 5p″ $^2F°$	
$4d^8(^1G)nx'''$	5, 6s‴ ^2G	5p‴ $^2F°$ 5p‴ $^2G°$ 5p‴ $^2H°$	5d‴ ^2D 5d‴ ^2F 5d‴ ^2G

* For predicted terms in the spectrum of the Rh I isoelectronic sequence, see Vol. III, Introduction.

Pd III

(Ru I sequence; 44 electrons) $Z=46$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^8\ {}^3F_4$

$a\ {}^3F_4$ **265600 K** I. P. 32.92 volts

The extensive analysis is by Shenstone, who has carried it out especially for inclusion here. His observations extend from 695A to 2950A. He has classified 800 lines and derived the limit 265900 from the $ns\ {}^{3,5}F$ series, ($n=5,6$) by means of a Ritz formula, with an assumed value of $\alpha=4\times10^{-6}$. The quoted value is from Catalán and Rico, who have obtained it by comparison of the third spectra from Y to In. Observed intersystem combinations connect the terms of different multiplicities.

Shenstone's investigation of this spectrum is so complete that only three levels "from the expected configurations" remain to be found. He emphasizes the fact that "the assignment of terms to ions is in many cases doubtful" and he feels that the levels should not be grouped into terms in the table. On account of the increased inaccuracy of all levels lower than $a\ {}^5F_5$ he suggests, also, that this level be adopted as zero.

The writer has rearranged his data to conform to the general format adopted for these Volumes. The users are urged to bear in mind the reservations made by Shenstone regarding this format and to consult him for further details.

REFERENCES

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Pd III

Config.	Desig.	J	Level	Interval
$4d^8$	$a\ ^3F$	4	0.0	−3229.7
		3	3229.7	−1457.6
		2	4687.3	
$4d^8$	$a\ ^1D$	2	10230.5	
$4d^8$	$a\ ^3P$	0	13699.1	−228.8
		1	13470.3	1164.0
		2	14634.3	
$4d^8$	$a\ ^1G$	4	17880.4	
$4d^7(^4F)5s$	$a\ ^5F$	5	52915.9	−2172.9
		4	55088.8	−1652.7
		3	56741.5	−1103.5
		2	57845.0	−682.3
		1	58527.3	
$4d^7(^4F)5s$	$b\ ^3F$	4	62560.9	−2694.5
		3	65255.4	−1824.0
		2	67079.4	
$4d^7(^4P)5s$	$a\ ^5P$	3	65708.0	−80.3
		2	65788.3	−1363.1
		1	67151.4	
$4d^7(^2G)5s$	$a\ ^3G$	5	69985.8	−1061.4
		4	71047.2	−1738.9
		3	72786.1	
$4d^7(^2P)5s$	$b\ ^3P$	2	72745.0	−257.6
		1	73002.6	−1278.6
		0	74281.2	
$4d^7(^2H)5s$	$a\ ^3H$	6	74673.3	−1294.3
		5	75967.6	−2613.5
		4	78581.1	
$4d^7(^2G)5s$	$b\ ^1G$	4	75403.0	
$4d^7(^4P)5s$	$c\ ^3P$	2	75455.0	−600.8
		1	76055.8	−2676.7
		0	78732.5?	
$4d^7(^2D)5s$	$a\ ^3D$	3	76231.4	−1938.4
		2	78169.8	49.8
		1	78120.0	
$4d^7(^2H)5s$	$a\ ^1H$	5	80805.1	
$4d^7(^2P)5s$	$a\ ^1P$	1	82620.3	
$4d^7(^2D)5s$	$b\ ^1D$	2	83204.3	
$4d^7(^2F)5s$	$c\ ^3F$	2	85420.7	409.7
		3	85830.4	964.8
		4	86795.2	
$4d^7(^2F)5s$	$a\ ^1F$	3	90684.3	
$4d^7(^2D)5s^1$	$b\ ^3D$	1	103529.4?	20.2
		2	103549.6	869.5
		3	104419.1	
$4d^7(^4F)5p$	$z\ ^5F^\circ$	5	*105145.4*	726.7
		4	*104418.7*	−2474.8
		3	*106893.5*	−1748.2
		2	*108641.7*	−1138.4
		1	*109780.1*	
$4d^7(^4F)5p$	$z\ ^5D^\circ$	4	*108115.7*	−1608.8
		3	*109724.5*	−1216.5
		2	*110941.0*	−768.4
		1	*111709.4*	−137.8
		0	*111847.2*	
$4d^7(^4F)5p$	$z\ ^5G^\circ$	6	*109015.4*	−60.9
		5	*109076.3*	−1672.7
		4	*110749.0*	−882.2
		3	*111631.2*	−171.7
		2	*111802.9*	

Pd III

Config.	Desig.	J	Level	Interval
$4d^7(^4P)5p$	$z\ ^5S^\circ$	2	*112328.6*	
$4d^7(^4F)5p$	$z\ ^3F^\circ$	4	*112449.3*	−1352.6
		3	*113801.9*	−1936.1
		2	*115738.0*	
$4d^7(^4F)5p$	$z\ ^3G^\circ$	5	*112506.9*	−2379.7
		4	*114886.6*	−1632.3
		3	*116518.9*	
$4d^7(^4F)5p$	$z\ ^3D^\circ$	3	*115736.6*	−1053.7
		2	*116790.3*	−776.3
		1	*117566.6*	
$4d^7(^4P)5p$	$z\ ^5P^\circ$	1	*119227.9*	815.2
		2	*120043.1*	179.3
		3	*120222.4*	
$4d^7(^2G)5p$	$z\ ^3H^\circ$	4	*122771.8*	−2083.9
		5	*120687.9*	2641.4
		6	*123329.3*	
$4d^7(^2G)5p$	$y\ ^3F^\circ$	4	*121161.5*	−3075.4
		3	*124236.9*	−3141.7
		2	*127378.6*	
$4d^7(^4P)5p$	$y\ ^5D^\circ$	0	*121652.6*	81.8
		1	*121734.4*	1258.7
		2	*122993.1*	510.3
		3	*123503.4*	−1603.6
		4	*121899.8*	
$4d^7(^2P)5p$	$z\ ^3P^\circ$?	2	*123313.1*	−2164.3
		1	*125477.4*	
		0		
$4d^7(^2P)5p$	$z\ ^3S^\circ$	1	*123779.0*	
$4d^7(^2G)5p$	$z\ ^1G^\circ$	4	*124431.9*	
$4d^7(^4P)5p$	$y\ ^3D^\circ$	3	*124644.3*	204.8
		2	*124439.5*	−536.6
		1	*124976.1*	
$4d^7(^2H)5p$	$y\ ^3G^\circ$	5	*124760.4*	−3224.7
		4	*127985.1*	−1697.4
		3	*129682.5*	
$4d^7(^2H)5p$	$z\ ^3I^\circ$	7	*127545.8*	2382.7
		6	*125163.1*	−2743.5
		5	*127906.6*	
$4d^7(^2G)5p$	$x\ ^3G^\circ$	5	*125389.9*	−1524.1
		4	*126914.0*	−103.5
		3	*127017.5*	
$4d^7(^2G)5p$	$z\ ^1F^\circ$	3	*125694.3*	
$4d^7(^4P)5p$	$y\ ^3P^\circ$	2	*126078.5*	−1071.0
		1	*127149.5*	
		0		
$4d^7(^2G)5p$	$z\ ^1H^\circ$	5	*127187.1*	
$4d^7(^2D)5p$	$x\ ^3D^\circ$	3	*127657.9*	−1140.0
		2	*128797.9*	−1043.5
		1	*129841.4*	
$4d^7(^2P)5p$	$w\ ^3D^\circ$	3	*128038.4*	−175.9
		2	*128214.3*	−286.8
		1	*128501.1*	
$4d^7(^2D)5p$	$x\ ^3F^\circ$	4	*130476.3*	−1568.4
		3	*132044.7*	1423.7
		2	*130621.0*	
$4d^7(^2H)5p$	$z\ ^1I^\circ$	6	*130959.3*	
$4d^7(^2P)5p$	$z\ ^1S^\circ$	0	*131482.8?*	

Pd III—Continued

Config.	Desig.	J	Level	Interval
$4d^7(^2H)5p$	$y\ ^3H^\circ$	6 5 4	*131550.6* *132300.5* *133450.2*	−749.9 −1149.7
$4d^7(^4P)5p$	$y\ ^3S^\circ$	1	*132181.2*	
$4d^7(^2P)5p$	$z\ ^1P^\circ$	1	*132716.7*	
$4d^7(^2D)5p$	$z\ ^1D^\circ$	2	*132748.9*	
$4d^7(^2P)5p$	$y\ ^1D^\circ$	2	*132951.1*	
$4d^7(^2H)5p$	$y\ ^1G^\circ$	4	*134638.8*	
$4d^7(^2F)5p$	$w\ ^3G^\circ$	3 4 5	*135159.3* *139049.1* *141874.2*	3889.8 2825.1
$4d^7(^2D)5p$	$x\ ^3P^\circ$	2 1 0	*135218.2* *137488.9* *137740.5?*	−2270.7 −251.6
$4d^7(^2D)5p$	$y\ ^1F^\circ$	3	*135356.8*	
$4d^7(^2D)5p$	$y\ ^1P^\circ$	1	*136782.3*	
$4d^7(^2H)5p$	$y\ ^1H^\circ$	5	*136847.4*	
$4d^7(^2F)5p$	$x\ ^1F^\circ$	3	*137160.6*	
$4d^7(^2F)5p$	$w\ ^3F^\circ$	2 3 4	*138415.5* *140473.3* *141980.1*	2057.8 1506.8
$4d^7(^2F)5p$	$x\ ^1D^\circ$	2	*140563.5*	
$4d^7(^2F)5p$	$x\ ^1G^\circ$	4	*141018.4*	
$4d^7(^2F)5p$	$v\ ^3D^\circ$	3 2 1	*141283.7* *142220.1?* *142103.0*	−936.4 117.1
$4d^7(^2D)5p$†	$w\ ^3P^\circ$	2 1 0	*153929.5* *154567.0* *155389.5*	−637.5 −822.5
$4d^7(^2D)5p$†	$u\ ^3D^\circ$	3 2 1	*156576.3*	
$4d^7(^4F)6s$	$e\ ^5F$	5 4 3 2 1	169831.1 170330.3 171785.4	−499.2 −1455.1
$4d^7(^4F)6s$	$e\ ^3F$	4 3 2	173635.6	
$4d^6\,5s(^6D)5p$	$y\ ^5F^\circ$	5 4 3 2 1	 *193222.5* *195160.0* *196545.1*	−1937.5 −1385.1
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Pd IV($^4F_{4\frac{1}{2}}$)	*Limit*	----	265600	

February 1957.

Pd III Observed Terms*

Configuration $1s^2\,2s^2\,2p^6\,3s^2$ $3p^6\,3d^{10}\,4s^2\,4p^6+$	Observed Terms											
$4d^8$	$a\ ^3P$	$a\ ^1D$	$a\ ^3F$	$a\ ^1G$								
	$ns\ (n\geq 5)$					$np\ (n\geq 5)$						
$4d^7(^4F)nx$			$a,e\ ^5F$ $b,e\ ^3F$					$z\ ^5D^\circ$ $z\ ^3D^\circ$	$z\ ^5F^\circ$ $z\ ^3F^\circ$	$z\ ^5G^\circ$ $z\ ^3G^\circ$		
$4d^7(^4P)nx$	$a\ ^5P$ $c\ ^3P$					$z\ ^5S^\circ$ $y\ ^3S^\circ$	$z\ ^5P^\circ$ $y\ ^3P^\circ$	$y\ ^5D^\circ$ $y\ ^3D^\circ$				
$4d^7(^2G)nx$				$a\ ^3G$ $b\ ^1G$					$y\ ^3F^\circ$ $z\ ^1F^\circ$	$x\ ^3G^\circ$ $z\ ^1G^\circ$	$z\ ^3H^\circ$ $z\ ^1H^\circ$	
$4d^7(^2P)nx$	$b\ ^3P$ $a\ ^1P$					$z\ ^3S^\circ$ $z\ ^1S^\circ$	$z\ ^3P^\circ$ $z\ ^1P^\circ$	$w\ ^3D^\circ$ $y\ ^1D^\circ$				
$4d^7(^2H)nx$					$a\ ^3H$ $a\ ^1H$					$y\ ^3G^\circ$ $y\ ^1G^\circ$	$y\ ^3H^\circ$ $y\ ^1H^\circ$	$z\ ^3I^\circ$ $z\ ^1I^\circ$
$4d^7(^2D)nx$		$a\ ^3D$ $b\ ^1D$					$x\ ^3P^\circ$ $y\ ^1P^\circ$	$x\ ^3D^\circ$ $z\ ^1D^\circ$	$x\ ^3F^\circ$ $y\ ^1F^\circ$			
$4d^7(^2F)nx$			$c\ ^3F$ $a\ ^1F$					$v\ ^3D^\circ$ $x\ ^1D^\circ$	$w\ ^3F^\circ$ $x\ ^1F^\circ$	$w\ ^3G^\circ$ $x\ ^1G^\circ$		
$4d^7(^2D)nx$†		$b\ ^3D$					$w\ ^3P^\circ$	$u\ ^3D^\circ$				
$4d^6\,5s(^6D)nx$									$y\ ^5F^\circ$			

*For predicted terms in the spectra of the Ru I isoelectronic sequence, see Vol. III, Introduction.

†This entry denotes the higher of the two ^2D limit terms for this configuration.

Pd XVIII

(Cu I sequence; 29 electrons) $Z=46$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s\ ^2S_{1/2}$

$4s\ ^2S_{1/2}$ K I. P. volts

This spectrum has not been analyzed, but Edlén has observed the doublets due to the transitions $4s$–$5p$, $4p$–$5d$, $4d$–$5f$, and $4p$–$5s$, from Pd XVIII to In XXI. In figure 3 of his paper on the spectra of highly-ionized atoms, the lines are indicated on the photograph of vacuum spark spectra of Pd observed from 40 A to 80 A.

By analogy with Cu I the writer has assumed the ground state indicated above.

REFERENCE

B. Edlén, Physica 13, No. 9, 549 (1947).

March 1953.

Pd XX

(Co I sequence; 27 electrons) $Z=46$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^9\ ^2D_{2\frac{1}{2}}$

$3d^9\ ^2D_{2\frac{1}{2}}$ K I. P. volts

This spectrum has not been analyzed, but Edlén has observed three lines due to the transition $3p^6\ 3d^9\ ^2D-3p^5\ 3d^{10}\ ^2P^\circ$, in the region between 40 A and 80 A. In figure 4 of his paper on the spectra of highly-ionized atoms, the observed wave numbers are plotted against atomic number for this combination in the Co I-like spectra Pd XX to Sn XXIV. For Pd XX the wave numbers are between 1500000 and 1800000 K.

REFERENCE

B. Edlén, Physica 13, No. 9, 548 (1947).

March 1953.

SILVER

Ag I

47 electrons $Z=47$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 5s\ ^2S_{0\frac{1}{2}}$

$5s\ ^2S_{0\frac{1}{2}}$ 61106.50 K I. P. 7.574 volts

The early work on this spectrum by Blair and others has been revised and extended by Shenstone. The analysis is from Shenstone's 1940 paper, supplemented by Rasmussen's extension of the $^2P^\circ$, ^2D, and $^2F^\circ$ series. For the terms common to the two papers, values of the latter have been used in the present compilation. Shenstone's notation is given in column 1 of the table.

About 190 lines have been classified in the range between 1507.37 A and 39951 A. The doublet and quartet systems of terms are connected by observed intersystem combinations.

Shenstone has determined the limit from the ^2S series, by using an extended Ritz formula. For 10 levels having as limit the ^3D term in Ag II, he has assigned the J-value of the limit, as is indicated in the configuration column.

The following g-values have been determined from Zeeman observations of five Ag I lines that appear as impurities on spectrograms measured at the National Bureau of Standards:

Desig.	J	Level	Obs. g
$5s\ ^2S$	0½	0.00	1.998
$5p\ ^2P^\circ$	0½	*29552.05*	0.666
	1½	*30472.71*	1.330
$6s\ ^2S$	0½	42556.15	1.995
$5d\ ^2D$	*1½*	*48744.00*	*0.801*

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E. Rasmussen, Det. Kgl. Danske Videnskab., Math-fys. Medd. (Copenhagen) **18**, 24 (1940). (T) (C L)

A. G. Shenstone, Phys. Rev. **72**, 1273 (L) (1947). (T)

J. E. Mack, Rev. Mod. Phys. **22**, No. 1, 64 (1950). (Summary hfs)

P. F. A. Klinkenberg, Rev. Mod. Phys. **24**, No, 2, 63 (1952). (Summary hfs).

H. E. Walchli, *A Table of Nuclear Moment Data*, Oak Ridge Nat. Lab., ORNL-1469, Suppl. II, 29 (1955). (Summary hfs)

Ag I

Author	Config.	Desig.	J	Level	Interval
$5s\ ^2S_{\frac12}$	$4d^{10}(^1S)5s$	$5s\ ^2S$	0½	0.00	
$5p\ ^2P_{\frac12}$ $5p\ ^2P_{1\frac12}$	$4d^{10}(^1S)5p$	$5p\ ^2P^\circ$	0½ 1½	*29552.05* *30472.71*	920.66
$5s^2\ ^2D_{2\frac12}$ $5s^2\ ^2D_{1\frac12}$	$4d^9\ 5s^2$	$5s^2\ ^2D$	2½ 1½	30242.26 34714.16	−4471.90
$6s\ ^2S_{\frac12}$	$4d^{10}(^1S)6s$	$6s\ ^2S$	0½	42556.15	
$6p\ ^2P_{\frac12}$ $6p\ ^2P_{1\frac12}$	$4d^{10}(^1S)6p$	$6p\ ^2P^\circ$	0½ 1½	*48297.38* *48500.77*	203.39
$5d\ ^2D_{1\frac12}$ $5d\ ^2D_{2\frac12}$	$4d^{10}(^1S)5d$	$5d\ ^2D$	1½ 2½	48744.00 48764.22	20.22
$7s\ ^2S_{\frac12}$	$4d^{10}(^1S)7s$	$7s\ ^2S$	0½	51886.98	
$7p\ ^2P_{\frac12}$ $7p\ ^2P_{1\frac12}$	$4d^{10}(^1S)7p$	$7p\ ^2P^\circ$	0½ 1½	*54040.99* *54121.16*	80.17
$6d\ ^2D_{1\frac12}$ $6d\ ^2D_{2\frac12}$	$4d^{10}(^1S)6d$	$6d\ ^2D$	1½ 2½	54203.13 54213.60	10.47
$4f\ ^2F$	$4d^{10}(^1S)4f$	$4f\ ^2F^\circ$	2½, 3½	*54204.73*	
$8s\ ^2S_{\frac12}$	$4d^{10}(^1S)8s$	$8s\ ^2S$	0½	55581.29	
$5s\ 5p\ ^4P_{2\frac12}$ $5s\ 5p\ ^4P_{1\frac12}$ $5s\ 5p\ ^4P_{\frac12}$	$4d^9\ 5s(^3D)5p$	$5p'\ ^4P^\circ$	2½ 1½ 0½	*56223.3* *58504.7* *60537.5*	−2281.4 −2032.8
$8p\ ^2P_{\frac12}$ $8p\ ^2P_{1\frac12}$	$4d^{10}(^1S)8p$	$8p\ ^2P^\circ$	0½ 1½	*56620.72* *56660.57*	39.85
	$4d^{10}(^1S)5f$	$5f\ ^2F^\circ$	2½, 3½	*56691.40*	
$7d\ ^2D_{1\frac12}$ $7d\ ^2D_{2\frac12}$	$4d^{10}(^1S)7d$	$7d\ ^2D$	1½ 2½	56699.79 56705.54	5.75
$5g\ ^2G$	$4d^{10}(^1S)5g$	$5g\ ^2G$	3½, 4½	56711.1	
$9s\ ^2S_{\frac12}$	$4d^{10}(^1S)9s$	$9s\ ^2S$	0½	57425.11	
 $9p\ ^2P_{1\frac12}$	$4d^{10}(^1S)9p$	$9p\ ^2P^\circ$	0½ 1½	*58005.20* *58027.10*	21.90
$8d\ ^2D_{1\frac12}$ $8d\ ^2D_{2\frac12}$	$4d^{10}(^1S)8d$	$8d\ ^2D$	1½ 2½	58050.01 58053.48	3.47
	$4d^{10}(^1S)6f$	$6f\ ^2F^\circ$	2½, 3½	*58055.56*	
$10s\ ^2S_{\frac12}$	$4d^{10}(^1S)10s$	$10s\ ^2S$	0½	58478.13	
$5s\ 5p\ ^4F_{4\frac12}$ $5s\ 5p\ ^4F_{3\frac12}$ $5s\ 5p\ ^4F_{2\frac12}$ $5s\ 5p\ ^4F_{1\frac12}$	$4d^9\ 5s(^3D)5p$	$5p'\ ^4F^\circ$	4½ 3½ 2½ 1½	*58901.9* *58789.7* *59321.1* *61241.9*	112.2 −531.4 −1920.8
	$4d^{10}(^1S)10p$	$10p\ ^2P^\circ$	0½ 1½	*58834.25* *58849.83*	15.58
$9d\ ^2D_{1\frac12}$ $9d\ ^2D_{2\frac12}$	$4d^{10}(^1S)9d$	$9d\ ^2D$	1½ 2½	58862.46 58864.66	2.20
$11s\ ^2S_{\frac12}$	$4d^{10}(^1S)11s$	$11s\ ^2S$	0½	59135.99	
$10d\ ^2D_{1\frac12}$ $10d\ ^2D_{2\frac12}$	$4d^{10}(^1S)10d$	$10d\ ^2D$	1½ 2½	59388.97 59390.72	1.75

Ag I

Author	Config.	Desig.	J	Level	Interval
$12s\ ^2S_{\frac12}$	$4d^{10}(^1S)12s$	$12s\ ^2S$	0½	59574.56	
$11d\ ^2D_{1\frac12}$ $11d\ ^2D_{2\frac12}$	$4d^{10}(^1S)11d$	$11d\ ^2D$	1½ 2½	59751.15 59751.51	0.36
$12d\ ^2D$	$4d^{10}(^1S)12d$	$12d\ ^2D$	1½, 2½	60007.6	
	Ag II ($^1S_0$)	*Limit*	------	61106.50	
$5s\ 5p\ ^4D_{3\frac12}$ $5s\ 5p\ ^4D_{2\frac12}$ $5s\ 5p\ ^4D_{1\frac12}$ $5s\ 5p\ ^4D_{0\frac12}$	$4d^9\ 5s(^3D)5p$	$5p'\ ^4D^\circ$	3½ 2½ 1½ 0½	*61773.1* *62181.6* *63530.7* *64576*	−408.5 −1349.1 −1045
$5s\ 5p\ ^2F_{2\frac12}$ $5s\ 5p\ ^2F_{3\frac12}$	$4d^9\ 5s(^3D)5p$	$5p'\ ^2F^\circ$	2½ 3½	*62933.7* *65637.6*	2703.9
$5s\ 5p\ ^2P$	$4d^9\ 5s(^3D)5p$	$5p'\ ^2P^\circ$	0½, 1½	*65986*	
$5s\ 5p\ ^2D_{1\frac12}$ $5s\ 5p\ ^2D_{2\frac12}$	$4d^9\ 5s(^3D)5p$	$5p'\ ^2D^\circ$	1½ 2½	*66340* *66972.0*	632
1°	$4d^9\ 5s(^1D)5p$	$5p''\ ^2F^\circ$	3½ 2½	*72334*	
2°	$4d^9\ 5s(^1D)5p$	$5p''\ ^2P^\circ$	1½ 0½	*73470*	
3°	$4d^9\ 5s(^1D)5p$	$5p''\ ^2D^\circ$	2½ 1½	*73587*	
$5s\ 6s\ ^4D_{3\frac12}$ $5s\ 6s\ ^4D_{2\frac12}$ $5s\ 6s\ ^4D_{1\frac12}$ $5s\ 6s\ ^4D_{\frac12}$	$4d^9\ 5s(^3D)6s$	$6s'\ ^4D$	3½ 2½ 1½ 0½	79412.9 80164 81266 83982.8	−751 −1102 −2717
$e\ ^2D_{2\frac12}$ $e\ ^2D_{1\frac12}$	$4d^9\ 5s(^3D)6s$	$6s'\ ^2D$	2½ 1½	82070 84594	−2524
$f\ ^2D_{2\frac12}$	$4d^9\ 5s(^1D)6s$	$6s''\ ^2D$	2½ 1½	86484	
$11_{2\frac12, 4\frac12}$	$4d^9\ 5s(^3D_3)5d$	11		86896	
$12_{3\frac12, 4\frac12}$	$4d^9\ 5s(^3D_3)5d$	12		87122.0	
$13_{2\frac12, 3\frac12}$	$4d^9\ 5s(^3D_3)5d$	13		87144	
$14_{2\frac12}$	$4d^9\ 5s(^3D_3)5d$	14	2½	87222	
$15_{3\frac12}$	$4d^9\ 5s(^3D_3)5d$	15	3½	87312.0	
$16_{2\frac12, 4\frac12}$	$4d^9\ 5s(^3D_3)5d$	16		87356.6	
17	$4d^9\ 5s(^3D_2)5d$	17	3½?	88594	
$18_{2\frac12}$	$4d^9\ 5s(^3D_2)5d$	18	2½	88738	
$19_{2\frac12, 3\frac12}$	$4d^9\ 5s(^3D_2)5d$	19		88816	
$5s\ 7s\ ^4D_{3\frac12}$	$4d^9\ 5s(^3D_3)7s$	$7s'\ ^4D$	3½ 2½ 1½ 0½	90366	
$20_{1\frac12, 2\frac12}$	$4d^9\ 5s?$	20		90612	

Ag I Observed Terms*

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6+$	Observed Terms				
$4d^9\ 5s^2$	$5s^2\ {}^2D$				
	$ns\ (n\geq5)$	$np\ (n\geq5)$	$nd\ (n\geq5)$	$nf\ (n\geq4)$	$ng\ (n\geq5)$
$4d^{10}({}^1S)ns$	5–12$s\ {}^2S$	5–10$p\ \ {}^2P^\circ$	5–12$d\ {}^2D$	4–6$f\ {}^2F^\circ$	5$g\ {}^2G$
$4d^9\ 5s({}^3D)ns'$	6, 7$s'\ {}^4D$ 6$s'\ {}^2D$	5$p'\ {}^4P^\circ$ 5$p'\ {}^4D^\circ$ 5$p'\ {}^4F^\circ$ 5$p'\ {}^2P^\circ$ 5$p'\ {}^2D^\circ$ 5$p'\ {}^2F^\circ$			
$4d^9\ 5s({}^1D)ns''$	6$s''\ {}^2D$	5$p''\ {}^2P^\circ$ 5$p''\ {}^2D^\circ$ 5$p''\ {}^2F^\circ$			

*For predicted terms of the Ag I isoelectronic sequence, see Vol. III, Introduction.

Ag II

(Pd I sequence; 46 electrons) $Z=47$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ {}^1S_0$

$4d^{10}\ {}^1S_0$ **173300 K** I. P. 21.48 volts

More than 380 lines of Ag II have been classified in the range from 728.73 A to 9052.69 A. The terms are from the papers by Gilbert and by Rasmussen, who have extended the early work of Shenstone, Blair, Duffendack and Thomson, Beals, and others.

Catalán and Rico have adjusted the value of the limit from a study of the spectra Sr II to Cd II. Their value is quoted here. Gilbert has derived the ionization limit 173274.0 K from the $4d^9\ ns\ {}^3D$ series (n=6 to 8) by means of a Ritz formula. To quote, "of the $4d^9\ ns\ {}^{3,1}D$ series the ${}^3D_3$ and ${}^3D_2$ series converge to the $4d^9\ {}^2D_{2\frac{1}{2}}$ state of Ag III, and the ${}^3D_1$ and ${}^1D_2$ series converge to $4d^9\ {}^2D_{1\frac{1}{2}}$". From these two limits he determines the interval of the ground term ${}^2D$ of Ag III as 4607 cm^{-1}. In the table the J-values of the limits are indicated.

The pair-coupling notation, introduced first in these Volumes for the inert gases to denote the departure from LS-coupling, applies also to spectra of the Pd I sequence. In the text of Pd I a small auxiliary table giving this notation, may be found.

The three-place g-values in the table are from unpublished Zeeman patterns of 37 lines measured by W. F. Meggers, C. C. Kiess, and C. J. Humphreys at the National Bureau of Standards. These Ag II lines appeared as impurities in various spectra, observed mostly at the Massachusetts Institute of Technology. The weakest determinations are indicated by a colon. Two-place entries are from the paper by Shenstone and Blair, who derived g-values from unresolved Zeeman patterns of Ag II from their formula for blended patterns.

Observed intersystem combinations connect the systems of terms of different multiplicities. The ground term has been connected with the rest by Shenstone from White's observations of three lines, subsequently confirmed by Menzies, as follows:

White		Menzies		Desig.
A (vac)	K	A (vac)	K	
1107.05	90330.2	1107.01	90333.4	$4d^{10}\ {}^1S_0 - 5p\ {}^3D^\circ_1$
1112.46	89890.9	1112.35	89899.8	$4d^{10}\ {}^1S_0 - 5p\ {}^1P^\circ_1$
1195.87	83621.1	1195.76	83628.8	$4d^{10}\ {}^1S_0 - 5p\ {}^3P^\circ_1$

Ag II—Continued

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E. Rasmussen, Kgl. Danske Videnskab., Math-fys. Medd. (Copenhagen) 18, No. 5, 10 (1940). (T) (C L) (I S)
M. A. Catalán y F. R. Rico, An. Real Soc. Esp. Fisica y Quimica (Madrid) [A] 48, 328 (1952) and letter (December 1950). (I P)

Ag II

Config.	Desig.	J	Level	Interval	Obs. g
$4d^{10}$	$4d^{10}\ ^1S$	0	0.0		
$4d^9(^2D_{2\frac{1}{2}})5s$	$5s\ ^3D$	3	39163.9	−1577.1	1.318
″		2	40741.0	−2997.7	1.119
$4d^9(^2D_{1\frac{1}{2}})5s$		1	43738.7		0.488
$4d^9(^2D_{1\frac{1}{2}})5s$	$5s\ ^1D$	2	46045.7		1.028
$4d^9(^2D_{2\frac{1}{2}})5p$	$5p\ ^3P^\circ$	2	*80172.20*	−3449.16	1.464
″		1	*83621.36*	−2514.66	1.410
$4d^9(^2D_{1\frac{1}{2}})5p$		0	*86136.02*		
$4d^9(^2D_{2\frac{1}{2}})5p$	$5p\ ^3F^\circ$	4	*83665.41*	1497.85	1.249
″		3	*82167.56*	−4716.39	1.059
$4d^9(^2D_{1\frac{1}{2}})5p$		2	*86883.95*		0.889
$4d^9(^2D_{2\frac{1}{2}})5p$	$5p\ ^3D^\circ$	3	*86456.54*	1259.93	1.240
″		2	*85196.61*	−5134.13	0.851
$4d^9(^2D_{1\frac{1}{2}})5p$		1	*90330.74*		0.52
$4d^9(^2D_{1\frac{1}{2}})5p$	$5p\ ^1F^\circ$	3	*89130.64*		1.076
$4d^9(^2D_{1\frac{1}{2}})5p$	$5p\ ^1P^\circ$	1	*89891.40*		1.008
$4d^9(^2D_{1\frac{1}{2}})5p$	$5p\ ^1D^\circ$	2	*90883.70*		1.099
$4d^8\ 5s^2$	$5s^2\ ^3F$	4	93928.66	−4029.15	
		3	97957.81	−1644.09	
		2	99601.90		
$4d^8\ 5s^2$	$5s^2\ ^3P$	2	105258.18	−3676.16	
		1	108934.34		
		0			
$4d^8\ 5s^2$	$5s^2\ ^1S$	0	109123.59		
$4d^8\ 5s^2$	$5s^2\ ^1D$	2	110769.41		
$4d^8\ 5s^2$	$5s^2\ ^1G$	4	113598.12		
$4d^9(^2D_{2\frac{1}{2}})6s$	$6s\ ^3D$	3	120529.45	−377.68	1.293:
″		2	120907.13	−4215.25	1.195:
$4d^9(^2D_{1\frac{1}{2}})6s$		1	125122.38		0.53
$4d^9(^2D_{1\frac{1}{2}})6s$	$6s\ ^1D$	2	125400.89		1.11
$4d^9(^2D_{2\frac{1}{2}})5d$	$5d\ ^3S$	1	125568.9		1.84
$4d^9(^2D_{2\frac{1}{2}})5d$	$5d\ ^3G$	5	126660.5	−12.6	
″		4	126673.1	−4573.2	1.03
$4d^9(^2D_{1\frac{1}{2}})5d$		3	131246.3		0.75?
$4d^9(^2D_{2\frac{1}{2}})5d$	$5d\ ^3P$	2	126760.2	−3.5	1.334
″		1	126763.7	−1765.1	0.90
″		0	128528.8		
$4d^9(^2D_{2\frac{1}{2}})5d$	$5d\ ^3D$	3	127205.0	−312.0	1.288:
″		2	127517.0	−3983.5	1.006:
$4d^9(^2D_{1\frac{1}{2}})5d$		1	131500.5		0.74
$4d^9(^2D_{2\frac{1}{2}})5d$	$5d\ ^3F$	4	127601.8	117.3	1.218:
″		3	127484.5	−4664.4	0.958
$4d^9(^2D_{1\frac{1}{2}})5d$		2	132148.9		0.71

Ag II

Config.	Desig.	J	Level	Interval	Obs. g
$4d^9(^2D_{2\frac{1}{2}})6p$	$6p\ ^3P^\circ$	2	*130721.01*	−2116.63	
″		1	*132837.64*	−3328.18	
$4d^9(^2D_{1\frac{1}{2}})6p$		0	*136165.82*		
$4d^9(^2D_{1\frac{1}{2}})5d$	$5d\ ^1P$	1	130756.0		1.51
$4d^9(^2D_{1\frac{1}{2}})5d$	$5d\ ^1G$	4	131510.5		1.065
$4d^9(^2D_{1\frac{1}{2}})5d$	$5d\ ^1D$	2	131783.9		1.147
$4d^9(^2D_{1\frac{1}{2}})5d$	$5d\ ^1F$	3	132191.8		1.095
$4d^9(^2D_{2\frac{1}{2}})6p$	$6p\ ^3F^\circ$	4	*132425.50*	411.97	
″		3	*132013.53*	−4501.38	
$4d^9(^2D_{1\frac{1}{2}})6p$		2	*136514.91*		
	1°	4	*132684.46*		
$4d^9(^2D_{2\frac{1}{2}})6p$	$6p\ ^3D^\circ$	3	*133017.94*	101.65	
″		2	*132916.29*	−4305.14	
$4d^9(^2D_{1\frac{1}{2}})6p$		1	*137221.43*		
	2°	2	*133137.81*		
	3°	2	*133589.4*		
	4°	3	*134339.04*		
$4d^9(^2D_{1\frac{1}{2}})5d$	$5d\ ^1S$	0	134449.4		
	5°	1	*134795.04*		
	6°	2	*135411.22*		
$4d^9(^2D_{1\frac{1}{2}})6p$	$6p\ ^1P^\circ$	1	*136828.51*		
$4d^9(^2D_{1\frac{1}{2}})6p$	$6p\ ^1F^\circ$	3	*137172.63*		
$4d^9(^2D_{1\frac{1}{2}})6p$	$6p\ ^1D^\circ$	2	*137464.20*		
	7°	3	*138633.3*		
	8°	2	*139227.3*		
	9°	2	*140962.3*		
$4d^9(^2D_{2\frac{1}{2}})7s$	$7s\ ^3D$	3	144473.9	−145.1	
″		2	144619.0	−4459.4	
$4d^9(^2D_{1\frac{1}{2}})7s$		1	149078.4		
$4d^9(^2D_{1\frac{1}{2}})7s$	$7s\ ^1D$	2	149179.1		
$4d^9(^2D_{2\frac{1}{2}})8s$	$8s\ ^3D$	3	155085.3	−71.5	
″		2	155156.8	−4534.0	
$4d^9(^2D_{1\frac{1}{2}})8s$		1	159690.8		
$4d^9(^2D_{1\frac{1}{2}})8s$	$8s\ ^1D$	2	159738.8		
Ag III $(^2D_{2\frac{1}{2}})$	*Limit*	-----	173300		
Ag III $(^2D_{1\frac{1}{2}})$	*Limit*	-----	177862		

March 1952.

Ag II Observed Terms*

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6+$	Observed Terms	
$4d^{10}$	$4d^{10}\ {}^1S$	
$4d^8\,5s^2$	$5s^2\ {}^1S$ $5s^2\ {}^3P$ $5s^2\ {}^1D$ $5s^2\ {}^3F$ $5s^2\ {}^1G$	
	$ns\ (n\geq5)$	$np\ (n\geq5)$
$4d^9(^2D)ns$	$5\text{–}8s\ {}^3D$ $5\text{–}8s\ {}^1D$	$5, 6p\ {}^3P^\circ$ $5, 6p\ {}^3D^\circ$ $5, 6p\ {}^3F^\circ$ $5, 6p\ {}^1P^\circ$ $5, 6p\ {}^1D^\circ$ $5, 6p\ {}^1F^\circ$
	$nd\ (n\geq5)$	
$4d^9(^2D)nd$	$5d\ {}^3S$ $5d\ {}^3P$ $5d\ {}^3D$ $5d\ {}^3F$ $5d\ {}^3G$ $5d\ {}^1S$ $5d\ {}^1P$ $5d\ {}^1D$ $5d\ {}^1F$ $5d\ {}^1G$	

*For predicted terms in the spectra of the Pd I isoelectronic sequence, see Vol. III, Introduction.

Ag III

(Rh I sequence; 45 electrons) Z=47

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^9\ {}^2D_{2\frac{1}{2}}$

$4d^9\ {}^2D_{2\frac{1}{2}}$ 280900 K I. P. 34.82 volts

The analysis is by Gilbert, who has observed the spectrum from 500 A to 3000 A, thereby revising and greatly extending the earlier work by B. V. R. Rao. Gilbert has published 257 classified lines between 709.80 A and 3013.81 A. The limit is from Catalán and Rico, who have interpolated it by comparison of third spectra from Y to In.

Observed intersystem combinations connect the doublet and quartet systems of terms.

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B. V. R. Rao, Proc. Indian Acad. Sci. 1A,28 (1934). (I P) (T) (C L)

W. P. Gilbert, Phys. Rev. 48, 338 (1935). (I P) (T) (C L)

M. A. Catalán y F. R. Rico, An. Real Soc. Esp. Fisica y Quimica (Madrid) [A] 53, 85 (1957). (I P)

Ag III

Config.	Desig.	J	Level	Interval
$4d^9$	$4d^9$ ^2D	$2\frac{1}{2}$ $1\frac{1}{2}$	0 4607	−4607
$4d^8(^3F)5s$	$5s$ ^4F	$4\frac{1}{2}$ $3\frac{1}{2}$ $2\frac{1}{2}$ $1\frac{1}{2}$	63250 65764 68145 69351	−2514 −2381 −1206
$4d^8(^3F)5s$	$5s$ ^2F	$3\frac{1}{2}$ $2\frac{1}{2}$	71691 73934	−2243
$4d^8(^3P)5s$	$5s'$ ^4P	$2\frac{1}{2}$ $1\frac{1}{2}$ $0\frac{1}{2}$	76406 77413 79326?	−1007 −1913
$4d^8(^1D)5s$	$5s''$ ^2D	$1\frac{1}{2}$ $2\frac{1}{2}$	80131 82231	2100
$4d^8(^3P)5s$	$5s'$ ^2P	$1\frac{1}{2}$ $0\frac{1}{2}$	85182 87477	−2295
$4d^8(^1G)5s$	$5s'''$ ^2G	$4\frac{1}{2}$ $3\frac{1}{2}$	85599 85727	−128
$4d^8(^3F)5p$	$5p$ $^4D^\circ$	$3\frac{1}{2}$ $2\frac{1}{2}$ $1\frac{1}{2}$ $0\frac{1}{2}$	*115412* *119143* *122014* *123408*	−3731 −2871 −1394
$4d^8(^3F)5p$	$5p$ $^4G^\circ$	$5\frac{1}{2}$ $4\frac{1}{2}$ $3\frac{1}{2}$ $2\frac{1}{2}$	*120359* *117931* *121068* *122532*	2428 −3137 −1464
$4d^8(^3F)5p$	$5p$ $^4F^\circ$	$4\frac{1}{2}$ $3\frac{1}{2}$ $2\frac{1}{2}$ $1\frac{1}{2}$	*122300* *123631* *126208* *123927*	−1331 −2577 2281
$4d^8(^3F)5p$	$5p$ $^2D^\circ$	$2\frac{1}{2}$ $1\frac{1}{2}$	*125095* *127870*	−2775
$4d^8(^3F)5p$	$5p$ $^2G^\circ$	$4\frac{1}{2}$ $3\frac{1}{2}$	*125250* *127729*	−2479
$4d^8(^3F)5p$	$5p$ $^2F^\circ$	$3\frac{1}{2}$ $2\frac{1}{2}$	*126732* *128804*	−2072
$4d^8(^3P)5p$	$5p'$ $^4P^\circ$	$0\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$	*129143* *129937* *130152*	794 215
$4d^8(^1D)5p$	$5p''$ $^2F^\circ$	$2\frac{1}{2}$ $3\frac{1}{2}$	*131876* *133636*	1760
$4d^8(^1D)5p$	$5p''$ $^2P^\circ$	$0\frac{1}{2}$ $1\frac{1}{2}$	*133467* *134955*	1488
$4d^8(^1D)5p$	$5p''$ $^2D^\circ$	$1\frac{1}{2}$ $2\frac{1}{2}$	*135356* *135762*	406
$4d^8(^3P)5p$	$5p'$ $^4D^\circ$	$0\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$ $3\frac{1}{2}$	 *136808* *136931* *136976*	123 45
$4d^8(^1G)5p$	$5p'''$ $^2H^\circ$	$4\frac{1}{2}$ $5\frac{1}{2}$	*136809* *139942*	3133
$4d^8(^3P)5p$	$5p'$ $^2D^\circ$	$2\frac{1}{2}$ $1\frac{1}{2}$	*138849* *139322*	−473
$4d^8(^3P)5p$	$5p'$ $^2P^\circ$	$1\frac{1}{2}$ $0\frac{1}{2}$	*140078* *143781*	−3703
$4d^8(^1G)5p$	$5p'''$ $^2F^\circ$	$3\frac{1}{2}$ $2\frac{1}{2}$	*140881* *142165*	−1284
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Ag IV ($^3F_4$)	*Limit*	------	280900	

February 1957.

Ag III Observed Terms*

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2$ $3p^6\ 3d^{10}\ 4s^2\ 4p^6+$	Observed Terms	
$4d^9$	$4d^9$ ^2D	
	ns $(n \geq 5)$	np $(n \geq 5)$
$4d^8(^3F)nx$	$\{$ $5s$ ^4F $5s$ ^2F	$5p$ $^4D^\circ$ $5p$ $^4F^\circ$ $5p$ $^4G^\circ$ $5p$ $^2D^\circ$ $5p$ $^2F^\circ$ $5p$ $^2G^\circ$
$4d^8(^3P)nx'$	$\{$ $5s'$ ^4P $5s'$ ^2P	$5p'$ $^4P^\circ$ $5p'$ $^4D^\circ$ $5p'$ $^2P^\circ$ $5p'$ $^2D^\circ$
$4d^8(^1D)nx''$	$5s''$ ^2D	$5p''$ $^2P^\circ$ $5p''$ $^2D^\circ$ $5p''$ $^2F^\circ$
$4d^8(^1G)nx'''$	$5s'''$ ^2G	$5p'''$ $^2F^\circ$ $5p'''$ $^2H^\circ$

*For predicted terms in the spectra of the Rh I isoelectronic sequence, see Vol. III, Introduction.

Ag XIX

(Cu I sequence; 29 electrons) $Z=47$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s\ ^2S_{1/2}$

$4s\ ^2S_{1/2}$ K I. P. volts

This spectrum has not been analyzed, but Edlén has observed the doublets due to the transitions $4s$–$5p$, $4p$–$5d$, $4d$–$5f$, and $4p$–$5s$, from Pd XVIII to In XXI. In figure 3 of his paper on the spectra of highly-ionized atoms, the lines are indicated on the photograph of vacuum spark spectra of Ag observed from 40 A to 80 A.

By analogy with Cu I the writer has assumed the ground state indicated above.

REFERENCE

B. Edlén, Physica 13, No. 9, 549 (1947).

March 1952.

Ag XXI

(Co I sequence; 27 electrons) $Z=47$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^9\ ^2D_{2\frac{1}{2}}$

$3d^9\ ^2D_{2\frac{1}{2}}$ K I. P. volts

This spectrum has not been analyzed, but Edlén has observed three lines due to the transition $3p^6\ 3d^9\ ^2D-3p^5\ 3d^{10}\ ^2P^\circ$, in the region between 40 A and 80 A. In figure 4 of his paper on the spectra of highly-ionized atoms, the observed wave numbers are plotted against atomic number for this combination in the Co I-like spectra Pd XX to Sn XXIV. For Ag XXI the wave numbers are between 1500000 and 1900000 K.

REFERENCE

B. Edlén, Physica 13, No. 9, 548 (1947).

March 1952.

CADMIUM

Cd I

48 electrons $Z=48$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,5s^2\ {}^1S_0$

$5s^2\ {}^1S_0$ 72538.8 K I. P. 8.991 volts

More than 200 lines in the spectrum have been classified. The observations extend from 682.85 A to nearly 39087 A, but the existing lists of wavelengths are not homogeneous. The accuracy of the present data could be greatly improved with modern observations, particularly in the infrared.

The early analysis was by Paschen and Götze and by Fowler, who found the leading series. The limit, and most of the terms in the table are from Fowler's Report. Ruark added the terms: 12 to $15s\ {}^1S$; 15, $16s\ {}^3S$; 9 to 11, 13 to $15d\ {}^1D$; 17 to $19d\ {}^3D$, and $5p^2\ {}^3P$. Shenstone and Pittenger revised the values of the terms 7 to $12d\ {}^3D$. Beutler observed in absorption 26 lines between 682 A and 1022 A, which he classifies as transitions from the ground term to terms above the ionization limit having the configurations $4d^9\,5s^2(^2D)np$ and $4d^9\,5s^2(^2D)nf$. The J-values of the limit term in Cd II, ^2D, are from this paper. *For these levels the values* of the observed wave numbers are entered in the table. For triplet terms only the component with $J=1$ is indicated, since only the combinations with the ground term ($J=0$) are to be expected.

Observed intersystem combinations connect the singlet and triplet systems of terms.

The entries in the table given to more than one decimal are from interferometer measurements of 18 lines, of which 14 are from the paper by Meggers and Burns, 3 from Hetzler, Boreman, and Burns, and 1 from Ignatieff. The level $5p^2\ {}^3P_2$ is from Garton and Rajaratnam, who have observed wide diffuse features at 2212 A and 2270 A which they designate as combinations of this level with $5p\ {}^3P_1^\circ$ and $5p\ {}^3P_2^\circ$, respectively.

Observations of forbidden transitions and of hyperfine structure are discussed in numerous papers. The Paschen-Back effect of the three lines at 4678 A, 4799 A, and 5085 A, $5p\ {}^3P^\circ-6s\ {}^3S$, are described in detail by Satô. Green and Gray give a similar report for six lines between 3403 A and 3614 A, $5p\ {}^3P_2^\circ-5d\ {}_3D$.

Cd I occupies a unique position among spectra in that it furnishes the primary standard of wavelength. The line 6438.4696 A, $5p\ {}^1P_1^\circ-5d\ {}^1D_2$ is the fundamental wavelength on which all other standards are based. The specifications for the production of this primary standard are defined in the 1925 report of Commission 14 of the International Astronomical Union—the Commission on Standards of Wave-Length. The summary of the directly measured wavelengths "of the Cadmium Red Line in terms of the International Metre (1 A.$=1\times10^{-10}$ m)" is published in the 1950 report of this Commission.

Cd I—Continued

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Cd I

Config.	Desig.	J	Level	Interval
$4d^{10}\,5s^2$	$5s^2\ ^1S$	0	0.0	
$4d^{10}\,5s(^2S)5p$	$5p\ ^3P^\circ$	0	*30114.017*	
		1	*30656.130*	542.113
		2	*31826.996*	1170.866
$4d^{10}\,5s(^2S)5p$	$5p\ ^1P^\circ$	1	*43692.474*	
$4d^{10}\,5s(^2S)6s$	$6s\ ^3S$	1	51484.013	
$4d^{10}\,5s(^2S)6s$	$6s\ ^1S$	0	53310.16	
$4d^{10}\,5s(^2S)6p$	$6p\ ^3P^\circ$	0	*58390.9*	
		1	*58461.6*	70.7
		2	*58635.7*	174.1
$4d^{10}\,5s(^2S)5d$	$5d\ ^1D$	2	59219.824	
$4d^{10}\,5s(^2S)5d$	$5d\ ^3D$	1	59485.793	
		2	59497.895	12.102
		3	59516.017	18.122
$4d^{10}\,5s(^2S)6p$	$6p\ ^1P^\circ$	1	*59905.6*	
$4d^{10}\,5s(^2S)7s$	$7s\ ^3S$	1	62563.461	
$4d^{10}\,5s(^2S)7s$	$7s\ ^1S$	0	63086.7	
$4d^{10}\,5s(^2S)7p$	$7p\ ^3P^\circ$	0	*64995.9*	
		1	*65021.3*	25.4
		2	*65092.8*	71.5
$4d^{10}\,5s(^2S)6d$	$6d\ ^1D$	2	65134.871	
$4d^{10}\,5s(^2S)6d$	$6d\ ^3D$	1	65353.5	
		2	65359.3	5.8
		3	65367.257	8.0

Cd I

Config.	Desig.	J	Level	Interval
$4d^{10}\,5s(^2S)7p$	$7p\ ^1P^\circ$	1	*65494.2*	
$4d^{10}\,5s(^2S)4f$	$4f\ ^3F^\circ$	2, 3, 4	*65581.7*	
$4d^{10}\,5s(^2S)8s$	$8s\ ^3S$	1	66680.920	
$4d^{10}\,5s(^2S)8s$	$8s\ ^1S$	0	66904.7	
$4d^{10}\,5s(^2S)8p$	$8p\ ^3P^\circ$	0	*67829.6*	
		1	*67842.1*	12.5
		2	*67875.2*	33.1
$4d^{10}\,5s(^2S)7d$	$7d\ ^1D$	2	67837.1	
$4d^{10}\,5s(^2S)7d$	$7d\ ^3D$	1	67990.1	
		2	67992.9	2.8
		3	67997.5	4.6
$4d^{10}\,5s(^2S)8p$	$8p\ ^1P^\circ$	1	*68055.4*	
$4d^{10}\,5s(^2S)5f$	$5f\ ^3F^\circ$	2, 3, 4	*68093.7*	
$4d^{10}\,5s(^2S)9s$	$9s\ ^3S$	1	68682.2	
$4d^{10}\,5s(^2S)9s$	$9s\ ^1S$	0	68799.6	
$4d^{10}\,5s(^2S)8d$	$8d\ ^1D$	2	69292.5	
$4d^{10}\,5s(^2S)9p$	$9p\ ^3P^\circ$	0	*69314.5*	
		1	*69321.4*	6.9
		2	*69340.2*	18.8
$4d^{10}\,5s(^2S)8d$	$8d\ ^3D$	1	69400.5	
		2	69402.8	2.3
		3	69405.5	2.7

Cd I—Continued

Config.	Desig.	J	Level	Interval
$4d^{10}\,5s(^2S)9p$	$9p\ ^1P^\circ$	1	*69435.7*	
$4d^{10}\,5s(^2S)10s$	$10s\ ^3S$	1	69805.9	
$4d^{10}\,5s(^2S)10s$	$10s\ ^1S$	0	69873.1	
$4d^{10}\,5s(^2S)9d$	$9d\ ^1D$	2	70175.9	
$4d^{10}\,5s(^2S)10p$	$10p\ ^3P^\circ$	0, 1, 2	*70207.3*	
$4d^{10}\,5s(^2S)9d$	$9d\ ^3D$	1 2 3	70244.2 70245.5 70247.1	1.3 1.6
$4d^{10}\,5s(^2S)10p$	$10p\ ^1P^\circ$	1	*70262.6*	
$4d^{10}\,5s(^2S)11s$	$11s\ ^3S$	1	70501.2	
$4d^{10}\,5s(^2S)11s$	$11s\ ^1S$	0	70543.2	
$4d^{10}\,5s(^2S)10d$	$10d\ ^1D$	2	70741.9	
$4d^{10}\,5s(^2S)10d$	$10d\ ^3D$	1 2 3	70788.3 70789.0 70790.1	0.7 1.1
$4d^{10}\,5s(^2S)11p$	$11p\ ^1P^\circ$	1	*70800.0*	
$4d^{10}\,5s(^2S)12s$	$12s\ ^3S$	1	70962.0	
$4d^{10}\,5s(^2S)12s$	$12s\ ^1S$	0	70992.1	
$4d^{10}\,5s(^2S)11d$	$11d\ ^1D$	2	71119.5	
$4d^{10}\,5s(^2S)12p$	$12p\ ^1P^\circ$	1	*71167.9*	
$4d^{10}\,5s(^2S)11d$	$11d\ ^3D$	1 2 3	 71159.6 71160.6	1.0
$4d^{10}\,5s(^2S)13s$	$13s\ ^3S$	1	71281.8	
$4d^{10}\,5s(^2S)13s$	$13s\ ^1S$	0	71299.0	
$4d^{10}\,5s(^2S)12d$	$12d\ ^3D$	1 2 3	 71424.1 71425.0	0.9
$4d^{10}\,5s(^2S)14s$	$14s\ ^3S$	1	71515.6	
$4d^{10}\,5s(^2S)14s$	$14s\ ^1S$	0	71528.0	
$4d^{10}\,5s(^2S)13d$	$13d\ ^1D$	2	71596.3	
$4d^{10}\,5s(^2S)13d$	$13d\ ^3D$	1, 2, 3	71618.5	
$4d^{10}\,5s(^2S)15s$	$15s\ ^3S$	1	71689.6	
$4d^{10}\,5s(^2S)15s$	$15s\ ^1S$	0	71692.4	
$4d^{10}\,5s(^2S)14d$	$14d\ ^1D$	2	71748.9	
$4d^{10}\,5s(^2S)14d$	$14d\ ^3D$	1, 2, 3	71767.2	
$4d^{10}\,5s(^2S)16s$	$16s\ ^3S$	1	71818.6	
$4d^{10}\,5s(^2S)15d$	$15d\ ^1D$	2	71869.2	
$4d^{10}\,5s(^2S)15d$	$15d\ ^3D$	1, 2, 3	71880.7	

Cd I—Continued

Config.	Desig.	J	Level	Interval
$4d^{10}\,5s(^2S)16d$	$16d\ ^3D$	1, 2, 3	71972.1	
$4d^{10}\,5s(^2S)17d$	$17d\ ^3D$	1, 2, 3	72046.7	
$4d^{10}\,5s(^2S)18d$	$18d\ ^3D$	1, 2, 3	72108.2	
$4d^{10}\,5s(^2S)19d$	$19d\ ^3D$	1, 2, 3	72155.7	
Cd II ($^2S_{\frac{1}{2}}$)	*Limit*	-------	72538.8	
$4d^{10}\,5p^2$	$5p^2\ ^3P$	0 1 2	73996.2 74745.4 75860	749.2 1115
$4d^9\,5s^2(^2D_{2\frac{1}{2}})5p$	$5p''\ ^1P^\circ$	1	*97800*	
$4d^9\,5s^2(^2D_{1\frac{1}{2}})5p$	$5p''\ ^3P^\circ$	1	*103480*	
$4d^9\,5s^2(^2D_{1\frac{1}{2}})5p$	$5p''\ ^3D^\circ$	1	*104351*	
$4d^9\,5s^2(^2D_{2\frac{1}{2}})6p$	$6p''\ ^1P^\circ$	1	*127464*	
$4d^9\,5s^2(^2D_{1\frac{1}{2}})6p$	$6p''\ ^3P^\circ$	1	*132698*	
$4d^9\,5s^2(^2D_{1\frac{1}{2}})6p$	$6p''\ ^3D^\circ$	1	*133044*	
$4d^9\,5s^2(^2D_{2\frac{1}{2}})7p$	$7p''\ ^1P^\circ$	1	*134196*	
$4d^9\,5s^2(^2D_{2\frac{1}{2}})4f?$	$4f''\ ^3P^\circ?$	1	*135097*	
$4d^9\,5s^2(^2D_{2\frac{1}{2}})8p$	$8p''\ ^1P^\circ$	1	*137087*	
$4d^9\,5s^2(^2D_{2\frac{1}{2}})9p$	$9p''\ ^1P^\circ$	1	*138524*	
$4d^9\,5s^2(^2D_{2\frac{1}{2}})6f?$	$6f''\ ^3P^\circ?$	1	*138679*	
$4d^9\,5s^2(^2D_{2\frac{1}{2}})10p$	$10p''\ ^1P^\circ$	1	*139417*	
$4d^9\,5s^2(^2D_{1\frac{1}{2}})7p$	$7p''\ ^3P^\circ$	1	*139652*	
$4d^9\,5s^2(^2D_{2\frac{1}{2}})11p$	$11p''\ ^1P^\circ$	1	*139987*	
$4d^9\,5s^2(^2D_{2\frac{1}{2}})12p$	$12p''\ ^1P^\circ$	1	*140410*	
$4d^9\,5s^2(^2D_{2\frac{1}{2}})13p?$	$13p''\ ^1P^\circ?$	1	*140655*	
$4d^9\,5s^2(^2D_{1\frac{1}{2}})4f?$	$4f''\ ^1P^\circ$	1	*140655*	
$4d^9\,5s^2(^2D_{1\frac{1}{2}})8p$	$8p''\ ^3P^\circ$	1	*142613*	
$4d^9\,5s^2(^2D_{1\frac{1}{2}})5f?$	$5f''\ ^1P^\circ?$	1	*143203*	
$4d^9\,5s^2(^2D_{1\frac{1}{2}})9p$	$9p''\ ^3P^\circ$	1	*144134*	
$4d^9\,5s^2(^2D_{1\frac{1}{2}})6f$	$6f''\ ^1P^\circ?$	1	*144531*	
$4d^9\,5s^2(^2D_{1\frac{1}{2}})10p$	$10p''\ ^3P^\circ$	1	*145034*	
$4d^9\,5s^2(^2D_{1\frac{1}{2}})7f?$	$7f''\ ^1P^\circ?$	1	*145314*	
$4d^9\,5s^2(^2D_{1\frac{1}{2}})11p$	$11p''\ ^3P^\circ$	1	*145603*	
$4d^9\,5s^2(^2D_{1\frac{1}{2}})12p$	$12p''\ ^3P^\circ$	1	*145993*	
$4d^9\,5s^2(^2D_{1\frac{1}{2}})13p$	$13p''\ ^3P^\circ$	1	*146281*	
$4d^9\,5s^2(^2D_{1\frac{1}{2}})14p$	$14p''\ ^3P^\circ$	1	*146446*	

August 1955.

Cd I Observed Terms*

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6+$	Observed Terms			
$4d^{10}\,5s^2$	$5s^2\ ^1S$			
$4d^{10}\,5p^2$		$5p^2\ ^3P$		
	$ns\ (n\geq 6)$	$np\ (n\geq 5)$	$nd\ (n\geq 5)$	$nf\ (n\geq 4)$
$4d^{10}\,5s(^2S)nx$	$6\text{–}16s\ ^3S$ $6\text{–}15s\ ^1S$	$5\text{–}10p\ ^3P^\circ$ $5\text{–}12p\ ^1P^\circ$	$5\text{–}19d\ ^3D$ $5\text{–}11,13\text{–}15d\ ^1D$	$4, 5f\ ^3F^\circ$
$4d^9\,5s^2(^2D)nx''$		$5\text{–}14p''\ ^3P^\circ$ $5\text{–}6p''\ ^3D^\circ$ $5\text{–}13p''\ ^1P^\circ$		$4, 6f''\ ^3P^\circ?$ $4\text{–}7f''\ ^1P^\circ?$

*For predicted terms in the spectra of the Cd I isoelectronic sequence, see Vol. III, Introduction.

Cd II

(Ag I sequence; 47 electrons) $Z=48$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,5s\ ^2S_{1/2}$

$5s\ ^2S_{1/2}$ 136374.74 K I. P. 16.904 volts

The analysis is from the paper by Shenstone and Pittenger, who have revised and extended the earlier work by Takahashi and by von Salis. In the range from 761 A to 8066 A there are 256 classified lines. Shenstone's notation is given in the first column of the table. He has redetermined the limit from the ^2S and ^2D series; and stresses the irregularity of both the $^2P^\circ$ and $^2F^\circ$ series, as was pointed out by von Salis.

Observed intersystem combinations connect the doublet and quartet systems of terms. The combination $4f\ ^2F^\circ-5g\ ^2G$ has recently been observed by C. H. Corliss and R. J. Murphy at 9670.84 A and 9658.75 A. These observations furnish the value of $5g\ ^2G$ in the table, and fit well into the $ng\ ^2G$ series (n=6 to 11) reported earlier.

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Cd II

Author	Config.	Desig.	J	Level	Interval
$5s\ ^2S_{1/2}$	$4d^{10}(^1S)5s$	$5s\ ^2S$	0½	0.00	
$5p\ ^2P^{\circ}_{1/2}$ $5p\ ^2P^{\circ}_{1\frac{1}{2}}$	$4d^{10}(^1S)5p$	$5p\ ^2P^{\circ}$	0½ 1½	*44136.08* *46618.55*	2482.47
$a\ ^2D_{2\frac{1}{2}}$ $a\ ^2D_{1\frac{1}{2}}$	$4d^9\ 5s^2$	$5s^2\ ^2D$	2½ 1½	69258.91 74893.66	−5634.75
$6s\ ^2S_{1/2}$	$4d^{10}(^1S)6s$	$6s\ ^2S$	0½	82990.66	
$5d\ ^2D_{1\frac{1}{2}}$ $5d\ ^2D_{2\frac{1}{2}}$	$4d^{10}(^1S)5d$	$5d\ ^2D$	1½ 2½	89689.25 89843.78	154.53
$6p\ ^2P^{\circ}_{1/2}$ $6p\ ^2P^{\circ}_{1\frac{1}{2}}$	$4d^{10}(^1S)6p$	$6p\ ^2P^{\circ}$	0½ 1½	*94710.41* *95383.63*	673.22
$z\ ^4P^{\circ}_{2\frac{1}{2}}$ $z\ ^4P^{\circ}_{1\frac{1}{2}}$ $z\ ^4P^{\circ}_{1/2}$	$4d^9\ 5s(^3D)5p$	$5p'\ ^4P^{\circ}$	2½ 1½ 0½	*106189.20* *109440.86* *112196.50*	−3251.66 −2755.64
$7s\ ^2S_{1/2}$	$4d^{10}(^1S)7s$	$7s\ ^2S$	0½	107300.88	
$4f\ ^2F^{\circ}_{2\frac{1}{2}}$ $4f\ ^2F^{\circ}_{3\frac{1}{2}}$	$4d^{10}(^1S)4f$	$4f\ ^2F^{\circ}$	2½ 3½	*108419.47* *108432.43*	12.96
 $z\ ^4F^{\circ}_{3\frac{1}{2}}$ $z\ ^4F^{\circ}_{2\frac{1}{2}}$ $z\ ^4F^{\circ}_{1\frac{1}{2}}$	$4d^9\ 5s(^3D)5p$	$5p'\ ^4F^{\circ}$	4½ 3½ 2½ 1½	 *109736.82* *110168.11* *112785.19*	−431.29 −2617.08
$6d\ ^2D_{1\frac{1}{2}}$ $6d\ ^2D_{2\frac{1}{2}}$	$4d^{10}(^1S)6d$	$6d\ ^2D$	1½ 2½	110174.10 110247.60	73.50
$7p\ ^2P^{\circ}_{1/2}$ $7p\ ^2P^{\circ}_{1\frac{1}{2}}$	$4d^{10}(^1S)7p$	$7p\ ^2P^{\circ}$	0½ 1½	*112361.06* *112490.39*	129.33
$z\ ^4D^{\circ}_{3\frac{1}{2}}$ $z\ ^4D^{\circ}_{2\frac{1}{2}}$ $z\ ^4D^{\circ}_{1\frac{1}{2}}$ $z\ ^4D^{\circ}_{1/2}$	$4d^9\ 5s(^3D)5p$	$5p'\ ^4D^{\circ}$	3½ 2½ 1½ 0½	*114793.91?* *114952.30* *116225.71* *117988.79*	−158.39 −1273.41 −1763.08
$z\ ^2F^{\circ}_{2\frac{1}{2}}$ $z\ ^2F^{\circ}_{3\frac{1}{2}}$	$4d^9\ 5s(^3D)5p$	$5p'\ ^2F^{\circ}$	2½ 3½	*116953.70* *119373.19*	2419.49
$8s\ ^2S_{1/2}$	$4d^{10}(^1S)8s$	$8s\ ^2S$	0½	118040.65	
$5f\ ^2F^{\circ}_{3\frac{1}{2}}$ $5f\ ^2F^{\circ}_{2\frac{1}{2}}$	$4d^{10}(^1S)5f$	$5f\ ^2F^{\circ}$	3½ 2½	*118444.36* *118545.77*	−101.41
	$4d^{10}(^1S)5g$	$5g\ ^2G$	3½ 4½	} 118769.95	
$z\ ^2P^{\circ}_{1\frac{1}{2}}$ $z\ ^2P^{\circ}_{1/2}$	$4d^9\ 5s(^3D)5p$	$5p'\ ^2P^{\circ}$	1½ 0½	*119056.11* *119293.99*	−237.88
$7d\ ^2D_{1\frac{1}{2}}$ $7d\ ^2D_{2\frac{1}{2}}$	$4d^{10}(^1S)7d$	$7d\ ^2D$	1½ 2½	119522.72 119561.99	39.27
$z\ ^2D^{\circ}_{1\frac{1}{2}}$ $z\ ^2D^{\circ}_{2\frac{1}{2}}$	$4d^9\ 5s(^3D)5p$	$5p'\ ^2D^{\circ}$	1½ 2½	*120135.22* *121281.64*	1146.42
$8p\ ^2P^{\circ}_{1/2}$ $8p\ ^2P^{\circ}_{1\frac{1}{2}}$	$4d^{10}(^1S)8p$	$8p\ ^2P^{\circ}$	0½ 1½	*120618.46* *120711.18*	92.72
$9s\ ^2S_{1/2}$	$4d^{10}(^1S)9s$	$9s\ ^2S$	0½	123751.48	
$6f\ ^2F^{\circ}_{3\frac{1}{2}}$ $6f\ ^2F^{\circ}_{2\frac{1}{2}}$	$4d^{10}(^1S)6f$	$6f\ ^2F^{\circ}$	3½ 2½	*123972.10* *123988.39*	−16.29
$6g\ ^2G$	$4d^{10}(^1S)6g$	$6g\ ^2G$	3½ 4½	} 124151.26	
$8d\ ^2D_{1\frac{1}{2}}$ $8d\ ^2D_{2\frac{1}{2}}$	$4d^{10}(^1S)8d$	$8d\ ^2D$	1½ 2½	124613.30 124636.50	23.20
$9p\ ^2P^{\circ}_{1/2}$ $9p\ ^2P^{\circ}_{1\frac{1}{2}}$	$4d^{10}(^1S)9p$	$9p\ ^2P^{\circ}$	0½ 1½	*125223.06* *125254.49*	31.43

Cd II

Author	Config.	Desig.	J	Level	Interval
$10s\ ^2S_{1/2}$	$4d^{10}(^1S)10s$	$10s\ ^2S$	0½	127152.89	
$7f\ ^2F^{\circ}_{3\frac{1}{2}}$ $7f\ ^2F^{\circ}_{2\frac{1}{2}}$	$4d^{10}(^1S)7f$	$7f\ ^2F^{\circ}$	3½ 2½	*127249.09* *127283.04*	−33.95
$7g\ ^2G$	$4d^{10}(^1S)7g$	$7g\ ^2G$	3½ 4½	} 127396.62	
$9d\ ^2D_{1\frac{1}{2}}$ $9d\ ^2D_{2\frac{1}{2}}$	$4d^{10}(^1S)9d$	$9d\ ^2D$	1½ 2½	127697.43 127712.28	14.85
$10p\ ^2P^{\circ}_{1\frac{1}{2}}$ $10p\ ^2P^{\circ}_{1/2}$	$4d^{10}(^1S)10p$	$10p\ ^2P^{\circ}$	1½ 0½	*127996.73* *128076.3*	−79.6
$y\ ^2F^{\circ}_{3\frac{1}{2}}$ $y\ ^2F^{\circ}_{2\frac{1}{2}}$	$4d^9\ 5s(^1D)5p$	$5p''\ ^2F^{\circ}$	3½ 2½	*129189.5* *131718.2*	−2528.7
$11s\ ^2S_{1/2}$	$4d^{10}(^1S)11s$	$11s\ ^2S$	0½	129343.05	
$y\ ^2P^{\circ}_{1\frac{1}{2}}$	$4d^9\ 5s(^1D)5p$	$5p''\ ^2P^{\circ}$	1½ 0½	*129344.86*	
$8f\ ^2F^{\circ}_{2\frac{1}{2}}$ $8f\ ^2F^{\circ}_{3\frac{1}{2}}$	$4d^{10}(^1S)8f$	$8f\ ^2F^{\circ}$	2½ 3½	*129419.38* *129686.60*	267.22
$8g\ ^2G$	$4d^{10}(^1S)8g$	$8g\ ^2G$	3½ 4½	} 129502.43	
$10d\ ^2D_{1\frac{1}{2}}$ $10d\ ^2D_{2\frac{1}{2}}$	$4d^{10}(^1S)10d$	$10d\ ^2D$	1½ 2½	129708.50 129718.66	10.16
$11p\ ^2P^{\circ}_{1/2}$ $11p\ ^2P^{\circ}_{1\frac{1}{2}}$	$4d^{10}(^1S)11p$	$11p\ ^2P^{\circ}$	0½ 1½	*129956.3* *130216.6*	260.3
$12s\ ^2S_{1/2}$	$4d^{10}(^1S)12s$	$12s\ ^2S$	0½	130835.86	
$9f\ ^2F^{\circ}_{2\frac{1}{2}}$ $9f\ ^2F^{\circ}_{3\frac{1}{2}}$	$4d^{10}(^1S)9f$	$9f\ ^2F^{\circ}$	2½ 3½	*130878.61* *130925.82*	47.21
$9g\ ^2G$	$4d^{10}(^1S)9g$	$9g\ ^2G$	3½ 4½	} 130946.09	
$11d\ ^2D_{1\frac{1}{2}}$ $11d\ ^2D_{2\frac{1}{2}}$	$4d^{10}(^1S)11d$	$11d\ ^2D$	1½ 2½	131092.90 131100.14	7.24
$12p\ ^2P^{\circ}_{1/2}$ $12p\ ^2P^{\circ}_{1\frac{1}{2}}$	$4d^{10}(^1S)12p$	$12p\ ^2P^{\circ}$	0½ 1½	*131261.1* *131374.7*	113.6
$13s\ ^2S_{1/2}$	$4d^{10}(^1S)13s$	$13s\ ^2S$	0½	131899.07	
$10f\ ^2F^{\circ}_{3\frac{1}{2}}$ $10f\ ^2F^{\circ}_{2\frac{1}{2}}$	$4d^{10}(^1S)10f$	$10f\ ^2F^{\circ}$	3½ 2½	*131953.72?* *131961.87?*	−8.15
$10g\ ^2G$	$4d^{10}(^1S)10g$	$10g\ ^2G$	3½ 4½	} 131978.47	
$12d\ ^2D_{1\frac{1}{2}}$ $12d\ ^2D_{2\frac{1}{2}}$	$4d^{10}(^1S)12d$	$12d\ ^2D$	1½ 2½	132086.77 132092.18	5.41
 $13p\ ^2P^{\circ}_{1\frac{1}{2}}$	$4d^{10}(^1S)13p$	$13p\ ^2P^{\circ}$	0½ 1½	 *132280.4?*	
 $11f\ ^2F^{\circ}_{3\frac{1}{2}}$	$4d^{10}(^1S)11f$	$11f\ ^2F^{\circ}$	2½ 3½	 *132707.91?*	
$11g\ ^2G$	$4d^{10}(^1S)11g$	$11g\ ^2G$	3½ 4½	} 132742.26	
$13d\ ^2D_{1\frac{1}{2}}$ $13d\ ^2D_{2\frac{1}{2}}$	$4d^{10}(^1S)13d$	$13d\ ^2D$	1½ 2½	132824.25 132828.29	4.04
 $14d\ ^2D_{2\frac{1}{2}}$	$4d^{10}(^1S)14d$	$14d\ ^2D$	1½ 2½	 133389.76	
	Cd III ($^1S_0$)	*Limit*	----	136374.74	

March 1953.

Cd II OBSERVED TERMS*

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2$ $3p^6\ 3d^{10}\ 4s^2\ 4p^6+$	Observed Terms				
$4d^9\ 5s^2$	$5s^2\ {}^2D$				
	$ns\ (n \geq 5)$	$np\ (n \geq 5)$	$nd\ (n \geq 5)$	$nf\ (n \geq 4)$	$ng\ (n \geq 5)$
$4d^{10}(^1S)nx$	$5-13s\ {}^2S$	$5-13p\ \ {}^2P^\circ$	$5-14d\ {}^2D$	$4-11f\ {}^2F^\circ$	$5-11g\ {}^2G$
$4d^9\ 5s(^3D)nx'$		$5p'\ {}^4P^\circ$ $5p'\ {}^4D^\circ$ $5p'\ {}^4F^\circ$ $5p'\ {}^2P^\circ$ $5p'\ {}^2D^\circ$ $5p'\ {}^2F^\circ$			
$4d^9\ 5s(^1D)nx''$		$5p''\ {}^2P^\circ$ $5p''\ {}^2F^\circ$			

*For predicted terms in the spectra of the Ag I isoelectronic sequence, see Vol. III, Introduction.

Cd III

(Pd I sequence; 46 electrons) $Z=48$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ {}^1S_0$

$4d^{10}\ {}^1S_0$ 302300 K I. P. 37.47 volts

The analysis is by Shenstone and Pittenger, who have extended the early work by Gibbs and White and by McLennan, McLay, and Crawford, as well as that by Mazumder. The number of classified lines now totals 138; and the observations extend from 677 A to 3035 A. Inter-system combinations connecting the singlet and triplet systems of terms, have been observed.

Mack has noted that the sequence Pd I—Sn V shows a gradual transition from *LS*- to *jj*-coupling for levels from the $d^9\ s$ and $d^9\ p$ configurations. In Cd III Shenstone indicates the *J*-value of the limit for levels from the $d^9\ s$ and $d^9\ d$ configurations, as is done in *Jl*-coupling. In the text for Pd I the writer has included a table giving the *Jl*-coupling notation for the related pairs of levels in the form of notation suggested by Racah.

The limit from the $4d^9\ ns$ series ($n=5, 6$) is 304690. From the *s*-electron series in Cd I and Cd II Shenstone predicted "a reasonable value for the Ritz correction in the Cd III series," and thus obtained a more reliable determination of the limit than that derived from a Rydberg series of only two members. The quoted value is from Catalán and Rico who have derived it by comparison of the third spectra from Y to In.

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A. G. Shenstone and J. T. Pittenger, J. Opt. Soc. Am. **39**, 221 (1949). (I P) (T) (C L)

M. A. Catalán y F. R. Rico, An. Real Soc. Esp. Fisica y Quimica (Madrid) [A] **53**, 85 (1957). (I P)

Cd III

Config.	Desig.	J	Level	Interval
$4d^{10}$	$4d^{10}\ ^1S$	0	0.0	
$4d^9(^2D_{2\frac{1}{2}})5s$ ″ $4d^9(^2D_{1\frac{1}{2}})5s$	$5s\ ^3D$	3 2 1	80454.3 82354.6 86219.5	−1900.3 −3864.9
$4d^9(^2D_{1\frac{1}{2}})5s$	$5s\ ^1D$	2	88671.8	
$4d^9(^2D)5p$	$5p\ ^3P^\circ$	2 1 0	*133813.3* *138754.4* *142110.8*	−4941.1 −3356.4
$4d^9(^2D)5p$	$5p\ ^3F^\circ$	4 3 2	*139031.2* *136214.3* *142754.8*	2816.9 −6540.5
$4d^9(^2D)5p$	$5p\ ^3D^\circ$	3 2 1	*142891.8* *140429.4* *147624.8*	2462.4 −7195.4
$4d^9(^2D)5p$	$5p\ ^1P^\circ$	1	*146075.1*	
$4d^9(^2D)5p$	$5p\ ^1F^\circ$	3	*146090.6*	
$4d^9(^2D)5p$	$5p\ ^1D^\circ$	2	*148461.3*	
$4d^8\ 5s^2$	$5s^2\ ^3F$	4 3 2	179022.4 184094.3 185798.5	−5071.9 −1704.2
$4d^8\ 5s^2$	$5s^2\ ^3P$	2 1 0	191762.3 196123.7 196258.2	−4361.4 −134.5
$4d^8\ 5s^2$	$5s^2\ ^1D$	2	198431.0	
$4d^8\ 5s^2$	$5s^2\ ^1G$	4	200932.8	
$4d^9(^2D_{2\frac{1}{2}})5d$	$5d\ ^3S$	1	202966.1	
$4d^9(^2D_{2\frac{1}{2}})6s$ ″ $4d^9(^2D_{1\frac{1}{2}})6s$	$6s\ ^3D$	3 2 1	204421.1 204908.1 210220.5	−487.0 −5312.4
$4d^9(^2D_{2\frac{1}{2}})5d$ ″ $4d^9(^2D_{1\frac{1}{2}})5d$	$5d\ ^3G$	5 4 3	205119.4? 205296.7 210837.5	−177.3 −5540.8
$4d^9(^2D_{2\frac{1}{2}})5d$	$5d\ ^3P$	2 1 0	205407.0	
$4d^9(^2D_{2\frac{1}{2}})5d$ ″ $4d^9(^2D_{1\frac{1}{2}})5d$	$5d\ ^3D$	3 2 1	206087.7 206804.3 212049.8	−716.6 −5245.5
$4d^9(^2D_{2\frac{1}{2}})5d$ ″ $4d^9(^2D_{1\frac{1}{2}})5d$	$5d\ ^3F$	4 3 2	206967.8 206610.3 211924.8	357.5 −5314.5
$4d^9(^2D_{1\frac{1}{2}})5d$	$5d\ ^1P$	1	210147.1	
$4d^9(^2D_{1\frac{1}{2}})6s$	$6s\ ^1D$	2	210588.0	
$4d^9(^2D_{1\frac{1}{2}})5d$	$5d\ ^1G$	4	211518.5	
$4d^9(^2D_{1\frac{1}{2}})5d$	$5d\ ^1D$	2	212625.0	
$4d^9(^2D_{1\frac{1}{2}})5d$	$5d\ ^1F$	3	212708.2	
$4d^8\ 5s^2$	$5s^2\ ^1S$	0	213107.7	
Cd IV $(^2D_{2\frac{1}{2}})$	*Limit*	------	302300	

February 1957.

Cd III Observed Terms*

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6+$	Observed Terms	
$4d^{10}$	$4d^{10}\ ^1S$	
$4d^8\ 5s^2$	$5s^2\ ^1S$; $5s^2\ ^3P$; $5s^2\ ^1D$; $5s^2\ ^3F$; $5s^2\ ^1G$	
	$ns\ (n \geq 5)$	$np\ (n \geq 5)$
$4d^9(^2D)nx$	$5, 6s\ ^3D$ $5, 6s\ ^1D$	$5p\ ^3P^\circ$ $5p\ ^3D^\circ$ $5p\ ^3F^\circ$ $5p\ ^1P^\circ$ $5p\ ^1D^\circ$ $5p\ ^1F^\circ$
	$nd\ (n \geq 5)$	
$4d^9(^2D)nx$	$5d\ ^3S$ $5d\ ^3P$ $5d\ ^3D$ $5d\ ^3F$ $5d\ ^3G$ $5d\ ^1P$ $5d\ ^1D$ $5d\ ^1F$ $5d\ ^1G$	

*For predicted terms in the spectra of the Pd I isoelectronic sequence, see Vol. III, Introduction.

Cd IV

(Rh I sequence; 45 electrons) $Z=48$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^9\ {}^2D_{2\frac{1}{2}}$

$4d^9\ {}^2D_{2\frac{1}{2}}$ K I. P. volts

The analysis is from Green, who has classified 185 lines between 489.49 A and 1929.70 A. Observed intersystem combinations connect the doublet and quartet systems of terms. No series are known in Cd IV.

REFERENCE

M. Green, Phys. Rev. 60, 117 (1941). (T) (C L)

Cd IV

Config.	Desig.	J	Level	Interval
$4d^9$	$4d^9\ {}^2D$	2½ 1½	0 5812	−5812
$4d^8(^3F)5s$	$5s\ {}^4F$	4½ 3½ 2½ 1½	108704 111734 114758 116125	−3030 −3024 −1367
$4d^8(^3F)5s$	$5s\ {}^2F$	3½ 2½	118333 120557	−2224
$4d^8(^1G)5s$	$5s'''\ {}^2G$	4½ 3½	133860 134010	−150
$4d^8(^3F)5p$	$5p\ {}^4D^\circ$	3½ 2½ 1½ 0½	*172387* *177252* *180868* *182864*	−4865 −3616 −1996
$4d^8(^3F)5p$	$5p\ {}^4G^\circ$	5½ 4½ 3½ 2½	*179173* *175319* *179375* *180812*	3854 −4056 −1437
$4d^8(^3F)5p$	$5p\ {}^4F^\circ$	4½ 3½ 2½ 1½	*181672* *182973* *186307* *182176*	−1301 −3334 4131
$4d^8(^3F)5p$	$5p\ {}^2D^\circ$	2½ 1½	*184301* *187213*	−2912
$4d^8(^3F)5p$	$5p\ {}^2G^\circ$	4½ 3½	*185366* *188147*	−2781
$4d^8(^3F)5p$	$5p\ {}^2F^\circ$	3½ 2½	*187168* *188296*	−1128
$4d^8(^3P)5p$	$5p'\ {}^4P^\circ$	0½ 1½ 2½	*189404* *190411* *190694*	1007 283
$4d^8(^1D)5p$	$5p''\ {}^2F^\circ$	2½ 3½	*191953* *194367*	2414
$4d^8(^1D)5p$	$5p''\ {}^2P^\circ$	0½ 1½	*194212* *195542*	1330
$4d^8(^1D)5p$	$5p''\ {}^2D^\circ$	2½ 1½	*196255* *196485?*	−230
$4d^8(^3P)5p$	$5p'\ {}^4D^\circ$	0½ 1½ 2½ 3½	*196370* *198220* *198338* *197508*	1850 118 −830
$4d^8(^1G)5p$	$5p'''\ {}^2H^\circ$	4½ 5½	*196560* *201293*	4733
$4d^8(^3P)5p$	$5p'\ {}^2D^\circ$	2½ 1½	*199525* *200743*	−1218
$4d^8(^3P)5p$	$5p'\ {}^2P^\circ$	1½ 0½	*201967* *206402*	−4435
$4d^8(^3P)5p$	$5p'\ {}^2S^\circ$	0½	*202655*	
$4d^8(^1G)5p$	$5p'''\ {}^2F^\circ$	3½ 2½	*202836* *204196*	−1360
$4d^8(^3P)5p$	$5p'\ {}^4S^\circ$	1½	*204294*	

February 1956.

Cd IV Observed Terms*

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6+$	Observed Terms	
$4d^9$	$4d^9\ ^2D$	
	$ns\ (n\geq5)$	$np\ (n\geq5)$
$4d^8(^3F)ns$	$5s\ ^4F$ $5s\ ^2F$	$5p\ ^4D^\circ$ $5p\ ^4F^\circ$ $5p\ ^4G^\circ$ $5p\ ^2D^\circ$ $5p\ ^2F^\circ$ $5p\ ^2G^\circ$
$4d^8(^3P)ns'$		$5p'\ ^4S^\circ$ $5p'\ ^4P^\circ$ $5p'\ ^4D^\circ$ $5p'\ ^2S^\circ$ $5p'\ ^2P^\circ$ $5p'\ ^2D^\circ$
$4d^8(^1D)ns''$		$5p''\ ^2P^\circ$ $5p''\ ^2D^\circ$ $5p''\ ^2F^\circ$
$4d^8(^1G)ns'''$	$5s'''\ ^2G$	$5p'''\ ^2F^\circ$ $5p'''\ ^2H^\circ$

*For predicted terms in the spectra of the Rh I isoelectronic sequence, see Vol. III, Introduction.

Cd XX

(Cu I sequence; 29 electrons) $Z=48$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s\ ^2S_{1/2}$

$4s\ ^2S_{1/2}$ K I. P. volts

This spectrum has not been analyzed, but Edlén has observed the doublets due to the transitions $4s$–$5p$, $4p$–$5d$, $4d$–$5f$, and $4p$–$5s$, from Pd XVIII to In XXI. In figure 3 of his paper on the spectra of highly-ionized atoms, the lines are indicated on the photograph of vacuum spark spectra of Cd observed from 40 A to 80 A.

By analogy with Cu I the writer has assumed the ground state indicated above.

REFERENCE

B. Edlén, Physica 13, No. 9, 549 (1947).

March 1953.

Cd XXII

(Co I sequence; 27 electrons) $Z=48$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^9\ ^2D_{2\frac{1}{2}}$

$3d^9\ ^2D_{2\frac{1}{2}}$ K I. P. volts

This spectrum has not been analyzed, but Edlén has observed two lines due to the transition $3p^6\,3d^9\ ^2D-3p^5\,3d^{10}\ ^2P^\circ$, in the region between 40 A and 80 A. In figure 4 of his paper on the spectra of highly-ionized atoms, the observed wave numbers are plotted against atomic number for this combination in the Co I-like spectra Pd XX to Sn XXIV. For Cd XXII the wave numbers are between 1600000 K and 2000000 K.

REFERENCE

B. Edlén, Physica 13, No. 9, 548 (1947).

March 1953.

INDIUM

In I

49 electrons $Z=49$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 5s^2\ 5p\ ^2P^\circ_{1/2}$

$5p\ ^2P^\circ_{1/2}$ *46669.93* K I. P. 5.785 volts

Approximately 145 In I lines in the interval 1169 A to 12912 A have been classified. The most extensive term list is given in Paschen's 1938 paper, which includes the $5p^2\ ^4P$ term, reported by Sawyer and Lang and by Lansing, evaluated from measurements of hyperfine-structure components.

Paschen's level called "A", which he designates as part of the $6s'\ ^4P$ term, has been included in the table with the writer's tentative assignment of $J=2\frac{1}{2}$.

Edlén has pointed out that the term for which Paschen (1938) suggested the designation $5s\ 5p^2\ ^2D$ "must be $4f\ ^2F^\circ$, as it was originally identified in earlier papers".

The terms $5f\ ^2F^\circ$ and $6f\ ^2F^\circ$ have been added from infrared observations by Meggers and Murphy in the interval 6847 A to 12912 A. Their paper contains an excellent summary of the work on this spectrum. The term $5p^2\ ^2P$ has been published by Garton and also by Clearman; and the terms $5p^2\ ^2S$, $6p'\ ^2S$ are given in Garton's 1950 paper. The writer has received from Garton in advance of publication his manuscript giving revised values of these terms, and also the series terms $np'\ ^2S$ ($n=7, 8$), $ns\ ^2S$ ($n=16$ to 24), and $nd\ ^2D$ ($n=16$ to 30). He has observed the new series members in absorption, and from the ^2S series derives the limit 46670.5 $\pm$0.7 K.

Brackets in the table denote estimated values extrapolated from the series. Paschen's value of the limit, based on well-observed series, is quoted in the table. He derived it from an empirical formula of the Hicks type.

Observed intersystem combinations connect the quartet terms with the doublets.

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J. Ôkubo and S. Satô, Reports Tohoku Imp. Univ. (Sendai) [1] Prof. K. Honda Anniversary Vol. p. 8 (1936). (Z E) (hfs)

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W. R. S. Garton, Nature **166**, 150, 1950; Proc. Phys. Soc. London [A] **64**, 509 (1951). (T) (C L)

H. E. Clearman, J. Opt. Soc. Am. **42**, 374 (1952). (T) (C L)

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W. R. S. Garton, Proc. Phys. Soc. London [A] **67**, 864 (1954). (I P) (T) (C L)

H. E. Walchli, *A Table of Nuclear Moment Data*, Oak Ridge Nat. Lab., ORNL-1469, Suppl. II, 29 (1955). (Summary hfs)

B. Edlén, letter (February 1958). (T)

In I

Config.	Desig.	J	Level	Interval
$5s^2(^1S)5p$	$5p\ ^2P^\circ$	0½ 1½	0.00 2212.56	2212.56
$5s^2(^1S)6s$	$6s\ ^2S$	0½	24372.87	
$5s^2(^1S)6p$	$6p\ ^2P^\circ$	0½ 1½	31816.61 32114.79	298.18
$5s^2(^1S)5d$	$5d\ ^2D$	1½ 2½	32892.12 32915.42	23.30
$5s\ 5p^2$	$5p^2\ ^4P$	0½ 1½ 2½	34977.66 36020.80 37451.90	1043.14 1431.10
$5s^2(^1S)7s$	$7s\ ^2S$	0½	36301.69	
$5s^2(^1S)7p$	$7p\ ^2P^\circ$	0½ 1½	38861.35 38972.84	111.49
$5s^2(^1S)6d$	$6d\ ^2D$	1½ 2½	39048.48 39098.37	49.89
$5s^2(^1S)4f$	$4f\ ^2F^\circ$	2½ 3½	39707.29 39707.96	0.67
$5s^2(^1S)8s$	$8s\ ^2S$	0½	40636.71	
$5s^2(^1S)8p$	$8p\ ^2P^\circ$	0½ 1½	41827.10 41881.44	54.34
$5s^2(^1S)7d$	$7d\ ^2D$	1½ 2½	41836.23 41861.57	25.34
$5s^2(^1S)5f$	$5f\ ^2F^\circ$	2½, 3½	42290.0	
$5s^2(^1S)9s$	$9s\ ^2S$	0½	42718.55	
$5s^2(^1S)8d$	$8d\ ^2D$	1½ 2½	43335.63 43354.62	18.99
$5s^2(^1S)9p$	$9p\ ^2P^\circ$	0½ 1½	43369.09 43399.53	30.44
$5s^2(^1S)6f$	$6f\ ^2F^\circ$	2½, 3½	43584.4	
$5s^2(^1S)10s$	$10s\ ^2S$	0½	43880.83	
$5s^2(^1S)9d$	$9d\ ^2D$	1½ 2½	44234.26 44249.37	15.11
$5s^2(^1S)10p$	$10p\ ^2P^\circ$	0½ 1½	44375.17 44394.13	18.96
$5s^2(^1S)7f$	$7f\ ^2F^\circ$	2½ 3½	44406.90 44406.96	0.06
$5s^2(^1S)11s$	$11s\ ^2S$	0½	44595.86	
$5s^2(^1S)10d$	$10d\ ^2D$	1½ 2½	44815.06 44827.02	11.96
$5s^2(^1S)11p$	$11p\ ^2P^\circ$	0½ 1½	[44853.23] 44865.79	[12.56]
$5s^2(^1S)8f$	$8f\ ^2F^\circ$	3½ 2½	44988.70 44988.71	−0.01
$5s^2(^1S)12s$	$12s\ ^2S$	0½	45067.19	

In I

Config.	Desig.	J	Level	Interval
$5s^2(^1S)11d$	$11d\ ^2D$	1½ 2½	45211.51 45221.08	9.57
$5s^2(^1S)9f$	$9f\ ^2F^\circ$	3½ 2½	45303.31 45303.39	−0.08
$5s^2(^1S)13s$	$13s\ ^2S$	0½	45394.13	
$5s^2(^1S)12d$	$12d\ ^2D$	1½ 2½	45493.98 45502.04	8.06
$5s^2(^1S)10f$	$10f\ ^2F^\circ$	3½ 2½	45563.89 45564.04	−0.15
$5s^2(^1S)14s$	$14s\ ^2S$	0½	45630.44	
$5s^2(^1S)13d$	$13d\ ^2D$	1½ 2½	45702.08 45709.02	6.94
$5s^2(^1S)11f$	$11f\ ^2F^\circ$	2½ 3½	45756.50 45756.56	0.06
$5s^2(^1S)15s$	$15s\ ^2S$	0½	45806.88	
$5s^2(^1S)14d$	$14d\ ^2D$	1½ 2½	45859.30 45865.32	6.02
$5s^2(^1S)12f$	$12f\ ^2F^\circ$	2½ 3½	45902.92	
$5s^2(^1S)16s$	$16s\ ^2S$	0½	45941.9	
$5s^2(^1S)15d$	$15d\ ^2D$	1½ 2½	45982.2 45986.69	4.5
$5s^2(^1S)17s$	$17s\ ^2S$	0½	46047.4	
$5s^2(^1S)16d$	$16d\ ^2D$	1½ 2½	46078.6	
$5s^2(^1S)18s$	$18s\ ^2S$	0½	46131.6	
$5s^2(^1S)17d$	$17d\ ^2D$	1½ 2½	46156.1	
$5s^2(^1S)19s$	$19s\ ^2S$	0½	46200.0	
$5s^2(^1S)18d$	$18d\ ^2D$	1½ 2½	46219.9	
$5s^2(^1S)20s$	$20s\ ^2S$	0½	46255.6	
$5s^2(^1S)19d$	$19d\ ^2D$	1½ 2½	46272.3	
$5s^2(^1S)21s$	$21s\ ^2S$	0½	46302.1	
$5s^2(^1S)20d$	$20d\ ^2D$	1½ 2½	46316.0	
$5s^2(^1S)22s$	$22s\ ^2S$	0½	46342.2	
$5s^2(^1S)21d$	$21d\ ^2D$	1½ 2½	46352.7	
$5s^2(^1S)23s$	$23s\ ^2S$	0½	46374.9	
$5s^2(^1S)22d$	$22d\ ^2D$	1½ 2½	46384.3	

In I—Continued

Config.	Desig.	J	Level	Interval
$5s^2(^1S)24s$	$24s\ ^2S$	$0\frac{1}{2}$	46402.6	
$5s^2(^1S)23d$	$23d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	46410.6	
$5s^2(^1S)24d$	$24d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	46434.5	
$5s^2(^1S)25d$	$25d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	46455.2	
$5s^2(^1S)26d$	$26d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	46472.5	
$5s^2(^1S)27d$	$27d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	46488.1	
$5s^2(^1S)28d$	$28d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	46501.7	
$5s^2(^1S)29d$	$29d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	46514.2	
$5s^2(^1S)30d$	$30d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	46525.5	
In II ($^1S_0$)	*Limit*		*46669.93*	
$5s\ 5p^2$	$5p^2\ ^2S$	$0\frac{1}{2}$	59118	
$5s\ 5p^2$	$5p^2\ ^2P$	$0\frac{1}{2}$ $1\frac{1}{2}$	59657 60652	995
$5s\ 5p(^3P^\circ)6s$	$6s'\ ^4P^\circ$	$0\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$	 *68821.7*	
$5s\ 5p(^3P^\circ)6p$	$6p'\ ^2S$	$0\frac{1}{2}$	77997	
$5d\ 5p(^3P^\circ)7p$	$7p'\ ^2S$	$0\frac{1}{2}$	84651	
$5s\ 5p(^3P^\circ)8p$	$8p'\ ^2S$	$0\frac{1}{2}$	87700	

February 1958.

In I Observed Terms*

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}+$	Observed Terms			
$5s^2(^1S)5p$	$5p\ ^2P^\circ$			
$5s\ 5p^2$	$5p^2\ ^4P$ $5p^2\ ^2S$ $5p^2\ ^2P$			
	$ns\ (n \geq 6)$	$np\ (n \geq 6)$	$nd\ (n \geq 5)$	$nf\ (n \geq 4)$
$5s^2(^1S)nx$	$6–24s\ ^2S$	$6–11p\ ^2P^\circ$	$5–30d\ ^2D$	$4–12f\ ^2F^\circ$
$5s\ 5p(^3P^\circ)nx'$	$6s'\ ^4P^\circ$	$6–8p'\ ^2S$		

*For predicted terms in the spectra of the In I isoelectronic sequence, see Vol. III, Introduction.

In II

(Cd I sequence; 48 electrons) $Z=49$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,5s^2\ ^1S_0$

$5s^2\ ^1S_0$ 152195 K I. P. 18.86 volts

The analysis is from Paschen and Campbell, who have revised and extended the earlier work by Lang and Sawyer, and by others. Approximately 570 lines are classified between 680 A and 9246 A. Many lines exhibit conspicuous hyperfine structure which Paschen and Campbell discuss in detail along with their analysis of the fine structure. Each member of the G-series consists of one pair of double levels called $n\ ^+G_{5,4}$ and $n\ ^-G_{4,3}$ in the paper on analysis. In the table the writer has labeled the $n\ ^+G_{5,4}$ pair as $^{1,3}G_{5,4}$ and the $n\ ^-G_{4,3}$ pair as $^3G_{4,3}$ in accordance with the suggestion of Trees. By analogy, the ^+H and ^-H series are handled similarly in the table. There is evidently a mixing of J-values among the four levels of each series member.

Paschen and Campbell list absolute term values based on the H-series as derived by means of a Rydberg formula without a Ritz correction. Their limit, quoted above, is 18 K lower than the earlier value, by Lang and Sawyer.

Observed intersystem combinations connect the singlet and triplet systems of terms.

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F. Paschen und J. S. Campbell, Ann. der Phys. [5] 31, 29 (1938). (I P) (T) (C L) (hfs)
J. E. Mack, Rev. Mod. Phys. 22, No. 1, 64 (1950). (Summary hfs)
R. E. Trees, unpublished material (August 1953).

In II

Config.	Desig.	J	Level	Interval
$5s^2$	$5s^2\ ^1S$	0	0	
$5s(^2S)5p$	$5p\ ^3P^\circ$	0	*42275*	
		1	*43349*	1074
		2	*45827*	2478
$5s(^2S)5p$	$5p\ ^1P^\circ$	1	*63033.81*	
$5s(^2S)6s$	$6s\ ^3S$	1	93919.03	
$5s(^2S)6s$	$6s\ ^1S$	0	97025.36	
$5p^2$	$5p^2\ ^1D$	2	97628.61	
$5p^2$	$5p^2\ ^3P$	0	101603.3	
		1	103244.47	1641.2
		2	105560.19	2315.72
$5s(^2S)5d$	$5d\ ^3D$	1	102083.63	
		2	102169.63	86.00
		3	102303.23	133.60
$5s(^2S)6p$	$6p\ ^3P^\circ$	0	*107657.87*	
		1	*107837.17*	179.30
		2	*108425.52*	588.35
$5s(^2S)6p$	$6p\ ^1P^\circ$	1	*109775.39*	
$5s(^2S)5d$	$5d\ ^1D$	2	113880.07	
$5p^2$	$5p^2\ ^1S$	0	121284.71	
$5s(^2S)7s$	$7s\ ^3S$	1	121437.71	
$5s(^2S)7s$	$7s\ ^1S$	0	123368.04	
$5s(^2S)4f$	$4f\ ^3F^\circ$	2	*123637.85*	
		3	*123643.04*	5.19
		4	*123659.72*	16.68
$5s(^2S)4f$	$4f\ ^1F^\circ$	3	*123694.07*	
$5s(^2S)6d$	$6d\ ^3D$	1	124737.90	
		2	124771.87	33.97
		3	124825.30	53.43
$5s(^2S)6d$	$6d\ ^1D$	2	126666.16	
$5s(^2S)7p$	$7p\ ^3P^\circ$	0	*126928.03*	
		1	*126990.17*	62.14
		2	*127249.36*	259.19
$5s(^2S)7p$	$7p\ ^1P^\circ$	1	*127568.53*	
$5s(^2S)8s$	$8s\ ^3S$	1	133067.67	
$5s(^2S)8s$	$8s\ ^1S$	0	133549.12	
$5s(^2S)5f$	$5f\ ^3F^\circ$	2	*133935.63*	
		3	*133939.63*	4.00
		4	*133955.71*	16.08

In II—Continued

Config.	Desig.	J	Level	Interval
$5s(^2S)5f$	$5f\ ^1F^\circ$	3	133979.84	
$5s(^2S)5g$	$5g\ ^3G$ $^{1,3}G$	3, 4 4, 5	134507.18 134511.01	3.83
$5s(^2S)7d$	$7d\ ^3D$	1 2 3	134721.67 134739.19 134767.07	17.52 27.88
$5s(^2S)7d$	$7d\ ^1D$	2	135396.63	
$5s(^2S)8p$	$8p\ ^3P^\circ$	0 1 2	 135856.72 135994.5	137.8
$5s(^2S)8p$	$8p\ ^1P^\circ$	1	136092.10	
$5s(^2S)9s$	$9s\ ^3S$	1	139132.27	
$5s(^2S)9s$	$9s\ ^1S$	0	139382.53	
$5s(^2S)6f$	$6f\ ^3F^\circ$	2 3 4	139544.50 139547.83 139562.41	3.33 14.58
$5s(^2S)6f$	$6f\ ^1F^\circ$	3	139581.23	
$5s(^2S)6g$	$6g\ ^3G$ $^{1,3}G$	3, 4 4, 5	139916.70 139920.44	3.74
$5s(^2S)8d$	$8d\ ^3D$	1 2 3	140077.42 140087.88 140104.34	10.46 16.46
$5s(^2S)8d$	$8d\ ^1D$	2	140403.60	
$5s(^2S)9p$	$9p\ ^3P^\circ$	0 1 2	 140729.75 140817.6	87.8
$5s(^2S)9p$	$9p\ ^1P^\circ$	1	140840.13	
$5s(^2S)10s$	$10s\ ^3S$	1	142703.52	
$5s(^2S)10s$	$10s\ ^1S$	0	142852.13	
$5s(^2S)7f$	$7f\ ^3F^\circ$	2 3 4	142922.96 142925.37 142938.34	2.41 12.97
$5s(^2S)7f$	$7f\ ^1F^\circ$	3	142954.91	
$5s(^2S)7g$	$7g\ ^3G$ $^{1,3}G$	3, 4 4, 5	143178.79 143182.34	3.55
$5s(^2S)9d$	$9d\ ^3D$	1 2 3	143293.63 143300.48 143311.02	6.85 10.54
$5s(^2S)9d$	$9d\ ^1D$	2	143479.10	
$5s(^2S)10p$	$10p\ ^3P^\circ$	0 1 2	 143701.70 143735.81	34.1
$5s(^2S)10p$	$10p\ ^1P^\circ$	1	143758.23	
$5s(^2S)11s$	$11s\ ^3S$	1	144985.21	
$5s(^2S)11s$	$11s\ ^1S$	0	145081.50	
$5s(^2S)8f$	$8f\ ^3F^\circ$	2 3 4	145110.98 145112.70 145124.50	1.72 11.80
$5s(^2S)8f$	$8f\ ^1F^\circ$	3	145139.62	

In II—Continued

Config.	Desig.	J	Level	Interval
$5s(^2S)8g$	$8g\ ^3G$ $^{1,3}G$	3, 4 4, 5	145295.24 145298.81	3.57
$5s(^2S)8h$	$8h\ ^3H^\circ$	4, 5 5, 6	145381.51 145385.05	3.54
$5s(^2S)10d$	$10d\ ^3D$	1 2 3	145378.26 145382.99 145390.20	4.73 7.21
$5s(^2S)10d$	$10d\ ^1D$	2	145494.76	
$5s(^2S)11p$	$11p\ ^3P^\circ$	0 1 2	 145650.93 	
$5s(^2S)11p$	$11p\ ^1P^\circ$	1	145678.91	
$5s(^2S)12s$	$12s\ ^3S$	1	146532.37	
$5s(^2S)12s$	$12s\ ^1S$	0	146598.23	
$5s(^2S)9f$	$9f\ ^3F^\circ$	2 3 4	146609.33 146607.43 146619.81	−1.90 12.38
$5s(^2S)9f$	$9f\ ^1F^\circ$	3	146633.49	
$5s(^2S)9g$	$9g\ ^3G$ $^{1,3}G$	3, 4 4, 5	146745.44 146749.04	3.60
$5s(^2S)9h$	$9h\ ^3H^\circ$	4, 5 5, 6	146764.61 146768.15	3.54
$5s(^2S)11d$	$11d\ ^3D$	1 2 3	146807.73 146810.4 146815.83	2.7 5.4
$5s(^2S)11d$	$11d\ ^1D$	2	146885.43	
$5s(^2S)13s$	$13s\ ^3S$	1	147629.77	
$5s(^2S)10f$	$10f\ ^3F^\circ$	2 3 4	147677.75 147675.63 147687.14	−2.12 11.51
$5s(^2S)13s$	$13s\ ^1S$	0	147676.63	
$5s(^2S)10f$	$10f\ ^1F^\circ$	3	147699.57	
$5s(^2S)10g$	$10g\ ^3G$ $^{1,3}G$	3, 4 4, 5	147782.28 147785.81	3.53
$5s(^2S)10h$	$10h\ ^3H^\circ$ $10h\ ^{1,3}H^\circ$	4, 5 5, 6	147796.52 147800.06	3.54
$5s(^2S)12d$	$12d\ ^3D$	1 2 3	147828.63 147831.50 147835.53	2.87 4.03
$5s(^2S)12d$	$12d\ ^1D$	2	147884.13	
$5s(^2S)14s$	$14s\ ^3S$	1	148436.04	
$5s(^2S)11f$	$11f\ ^3F^\circ$	2 3 4	148467.23 148463.62 148475.19	−3.61 11.57
$5s(^2S)14s$	$14s\ ^1S$	0	148470.73	
$5s(^2S)11f$	$11f\ ^1F^\circ$	3	148486.65	
$5s(^2S)11g$	$11g\ ^3G$ $^{1,3}G$	3, 4 4, 5	148549.25 148552.80	3.55
$5s(^2S)11h$	$11h\ ^3H^\circ$ $^{1,3}H^\circ$	4, 5 5, 6	148560.11 148563.65	3.54

In II—Continued

Config.	Desig.	*J*	Level	Interval
5s(²S)13d	13d ³D	1 2 3	148584.8 148587.6 148590.9	2.8 3.3
5s(²S)13d	13d ¹D	2	148626.13	
5s(²S)15s	15s ³S	1	149046.06	
5s(²S)12f	12f ³F°	2 3 4	*149065.86* *149062.72* *149073.89*	−3.14 11.17
5s(²S)15s	15s ¹S	0	149072.46	
5s(²S)12f	12f ¹F°	3	*149084.04*	
5s(²S)12g	12g ³G	3, 4 4, 5	149132.24 149135.78	3.54
5s(²S)12h	12h ³H°	4, 5 5, 6	*149140.90* *149144.44*	3.54
5s(²S)14d	14d ³D	1 2 3	149160.5 149163.5 149165.4	3.0 1.9
5s(²S)14d	14d ¹D	2	[149192.0]	
5s(²S)16s	16s ³S	1	149519.15	
5s(²S)16s	16s ¹S	0	149539.30	
5s(²S)13g	13g ³G ¹,³G	3, 4 4, 5	149585.71 149589.25	3.54
5s(²S)13h	13h ³H°	4, 5 5, 6	*149592.72* *149596.26*	3.54
5s(²S)15d	15d ³D	1 2 3	149609.4 149609.86 149612.7	0.5 2.8
5s(²S)15d	15d ¹D	2	149633.23	
5s(²S)17s	17s ³S	1	149892.67	
5s(²S)17s	17s ¹S	0	[149906.8]	
5s(²S)14g	14g ³G ¹,³G	3, 4 4, 5	149945.47 149949.01	3.54
5s(²S)14h	14h ³H°	4, 5 5, 6	*149951.16* *149954.70*	3.54
5s(²S)16d	16d ³D	1 2 3	149963.4 149966.7 149967.5	3.3 0.8
5s(²S)16d	16d ¹D	2	[149983.88]	
5s(²S)18s	18s ³S	1	[150193.12]	
5s(²S)17d	17d ³D	1, 2 3	150253.2 150253.97	0.8
5s(²S)17d	17d ¹D	2	150267.05	
5s(²S)19s	19s ³S	1	[150438.41]	
5s(²S)18d	18d ³D	1 2, 3	150486.3 150488.6	2.3
5s(²S)18d	18d ¹D	2	[150499.27]	
5s(²S)19d	19d ³D	1 2 3	 150683.0	
In III ($^2S_{1/2}$)	*Limit*	-------	152195	

August 1953.

In II Observed Terms*

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}+$	Observed Terms		
$5s^2$	$5s^2\ ^1S$		
$5p^2$	$5p^2\ ^1S$	$5p^2\ ^3P$	$5p^2\ ^1D$
	ns ($n \geq 6$)	*np* ($n \geq 5$)	*nd* ($n \geq 5$)
$5s(^2S)nx$	6–17s ³S 6–16s ¹S	5–11p ³P° 5–11p ¹P°	5–19d ³D 5–13, 15, 17d ¹D
	nf ($n \geq 4$)	*ng* ($n \geq 5$)	*nh* ($n \geq 6$)
$5s(^2S)nx$	4–12f ³F° 4–12f ¹F°	5–14g ¹,³G	8–14h ¹,³H°

*For predicted terms in the spectra of the Cd I isoelectronic sequence, see Vol. III, Introduction.

In III

(Ag I sequence; 47 electrons) $Z=49$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,5s\ ^2S_{1/2}$

$5s\ ^2S_{1/2}$ **226100** K I. P. 28.03 volts

The analysis is from Nodwell, who has furnished his tentative results in advance of publication, especially for inclusion here. He has classified 56 lines in the interval 685.31 A to 6197.72 A. The $5p'\ ^4P^\circ$ term requires further confirmation.

The limit is from Catalán and Rico, who have derived it by comparison of the third spectra from Y to In.

REFERENCES

R. Nodwell, unpublished material (December 1955). (I P) (T) (C L)

M. A. Catalán y F. R. Rico, An. Real Soc. Esp. Fisica y Quimica (Madrid) [A] **53**, 85 (1957). (I P)

In III

Config.	Desig.	J	Level	Interval
$4d^{10}(^1S)5s$	$5s\ ^2S$	0½	0.0	
$4d^{10}(^1S)5p$	$5p\ ^2P^\circ$	0½ 1½	*57181.1* *61523.2*	4342.1
$4d^9\,5s^2$	$5s^2\ ^2D$	2½ 1½	115568.7 122414.8	−6846.1
$4d^{10}(^1S)6s$	$6s\ ^2S$	0½	126874.2	
$4d^{10}(^1S)5d$	$5d\ ^2D$	1½ 2½	128452.8 128742.5	289.7
$4d^{10}(^1S)6p$	$6p\ ^2P^\circ$	0½ 1½	*144583.6* *145922.6*	1339.0
$4d^9\,5s(^3D)5p$	$5p'\ ^4P^\circ$	2½ 1½ 0½	*158828?* *167628?* *171768.4?*	−8800 −4140
$4d^{10}(^1S)4f$	$4f\ ^2F^\circ$	2½ 3½	*161968.8* *161976.8*	8.0
$4d^{10}(^1S)7s$	$7s\ ^2S$	0½	169429.8	

In III

Config.	Desig.	J	Level	Interval
$4d^{10}(^1S)6d$	$6d\ ^2D$	1½ 2½	170531.8 170715.3	183.5
$4d^{10}(^1S)7p$	$7p\ ^2P^\circ$	0½ 1½	*180551.6?* *181150.9?*	599.3
$4d^{10}(^1S)5g$	$5g\ ^2G$	3½, 4½	186522.0	
$4d^{10}(^1S)8s$	$8s\ ^2S$	0½	189369.6	
$4d^{10}(^1S)7d$	$7d\ ^2D$	1½ 2½	190033.5 190131.9	98.4
$4d^{10}(^1S)6g$	$6g\ ^2G$	3½, 4½	198647.9	
$4d^{10}(^1S)9s$	$9s\ ^2S$	0½	201149.0?	
$4d^{10}(^1S)7g$	$7g\ ^2G$	3½, 4½	205961.3	
In IV $(^1S_0)$	*Limit*	------	**226100**	

February 1957.

In IV

(Pd I sequence; 46 electrons) $Z=49$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\;{}^1S_0$

$4d^{10}\;{}^1S_0$ 439000 K I. P. 54.4 volts

The analysis is by Gibbs and White, who have classified 36 lines between 472.48 A and 1725.91 A. Observed combinations connect the singlet and triplet systems of terms.

The writer has interpolated the limit quoted here, from the isoelectronic spectra Pd I through Sn V. This gives an ionization potential 3.5 volts less than the one quoted by Kruger and Shoupp, which in turn is from a Moseley diagram by Gibbs and White.

Crooker and Nodwell have recently observed the spectrum with a vacuum-spark source and will doubtless be able to revise and extend the present analysis.

REFERENCES

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P. G. Kruger and W. E. Shoupp, Phys. Rev. **46**, 124 (1934). (I P)

A. M. Crooker and R. Nodwell, letter (December 1955).

In IV

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$4d^{10}$	$4d^{10}\;{}^1S$	0	0		$4d^9(^3D)5p$	$5p\;{}^3D^\circ$	3	*205953*	
$4d^9(^2D_{2\frac{1}{2}})5s$	$5s\;{}^3D$	3	128785				2	*202129*	3824
"		2	130981	−2196			1	*211650*	−9521
$4d^9(^2D_{1\frac{1}{2}})5s$		1	135893	−4912	$4d^9(^3D)5p$	$5p\;{}^1P^\circ$	1	*208702*	
$4d^9(^2D_{1\frac{1}{2}})5s$	$5s\;{}^1D$	2	138764		$4d^9(^3D)5p$	$5p\;{}^1F^\circ$	3	*209886*	
$4d^9(^3D)5p$	$5p\;{}^3P^\circ$	2	*194004*		$4d^9(^3D)5p$	$5p\;{}^1D^\circ$	2	*212785*	
		1	*200662*	−6658					
		0	*205057*	−4395	--------------	-------	----	--------	
$4d^9(^3D)5p$	$5p\;{}^3F^\circ$	4	*201158*		In V$(^2D_{2\frac{1}{2}})$	*Limit*	----	439000	
		3	*196706*	4452					
		2	*205357*	−8651					

January 1956.

In V

(Rh I sequence; 45 electrons) Z=49

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^9\ {}^2D_{2\frac{1}{2}}$

$4d^9\ {}^2D_{2\frac{1}{2}}$ K I. P. volts

The spectrum is incompletely known. The analysis is from Green, who has classified 43 lines between 368.67 A and 423.16 A. Observed intersystem combinations connect the doublet and quartet systems of terms. No series have been found.

REFERENCE

M. Green, Phys. Rev. 60, 117 (1941). (T) (C L)

In V

Config.	Desig.	J	Level	Interval
$4d^9$	$4d^9\ {}^2D$	2½ 1½	0 7165	−7165
$4d^8(^3F)5p$	$5p\ {}^4D°$	3½ 2½ 1½ 0½	*236317* *241051* *246142*	−4734 −5091
$4d^8(^3F)5p$	$5p\ {}^4G°$	5½ 4½ 3½ 2½	 *245128*	
$4d^8(^3F)5p$	$5p\ {}^4F°$	4½ 3½ 2½ 1½	 *248515* *252691* *246713*	−4176 5978
$4d^8(^3F)5p$	$5p\ {}^2D°$	2½ 1½	*249644* *252648*	−3004
$4d^8(^3F)5p$	$5p\ {}^2F°$	3½ 2½	*253878*	
$4d^8(^3F)5p$	$5p\ {}^2G°$	4½ 3½	 *254803*	
$4d^8(^3P)5p$	$5p'\ {}^4P°$	2½ 1½ 0½	*257129* *257294*	−165

In V

Config.	Desig.	J	Level	Interval
$4d^8(^1D)5p$	$5p''\ {}^2F°$	2½ 3½	*258598* *261260*	2662
$4d^8(^1D)5p$	$5p''\ {}^2P°$	0½ 1½	*261230* *262082*	852
$4d^8(^1D)5p$	$5p''\ {}^2D°$	2½ 1½	*262971* *263556?*	−585
$4d^8(^3P)5p$	$5p'\ {}^4D°$	3½ 2½ 1½ 0½	*264124* *266071* *265908*	−1947 163
$4d^8(^3P)5p$	$5p'\ {}^2D°$	1½ 2½	*268226* *268849*	623
$4d^8(^3P)5p$	$5p'\ {}^2P°$	1½ 0½	*270197* *275305*	−5108
$4d^8(^3P)5p$	$5p'\ {}^2S°$	0½	*270850*	
$4d^8(^1G)5p$	$5p'''\ {}^2F°$	3½ 2½	*271245* *272565*	−1320
$4d^8(^3P)5p$	$5p'\ {}^4S°$	1½	*273867*	

February 1956.

In v Observed Terms*

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6+$	Observed Terms				
$4d^9$	$4d^9\ ^2D$				
	$np\ (n \geq 5)$				
$4d^8(^3F)ns$			$5p\ ^4D^\circ$ $5p\ ^2D^\circ$	$5p\ ^4F^\circ$ $5p\ ^2F^\circ$	$5p\ ^4G^\circ$ $5p\ ^2G^\circ$
$4d^8(^3P)ns'$	$5p'\ ^4S^\circ$ $5p'\ ^2S^\circ$	$5p'\ ^4P^\circ$ $5p'\ ^2P^\circ$	$5p'\ ^4D^\circ$ $5p'\ ^2D^\circ$		
$4d^8(^1D)ns''$		$5p''\ ^2P^\circ$	$5p''\ ^2D^\circ$	$5p''\ ^2F^\circ$	
$4d^8(^1G)ns'''$				$5p'''\ ^2F^\circ$	

*For predicted terms in the spectra of the Rh I isoelectronic sequence, see Vol. III, Introduction.

In XXI

(Cu I sequence; 29 electrons) $Z=49$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s\ ^2S_{1/2}$

$4s\ ^2S_{1/2}$ K I. P. volts

This spectrum has not been analyzed, but Edlén has observed the doublets due to the transitions $4s$–$5p$, $4p$–$5d$, $4d$–$5f$, and $4p$–$5s$, from Pd XVIII to In XXI. In figure 3 of his paper on the spectra of highly-ionized atoms, the lines are indicated on the photograph of vacuum spark spectra of In observed from 40 A to 80 A.

By analogy with Cu I the writer has assumed the ground state indicated above.

REFERENCE

B. Edlén, Physica 13, No. 9, 549 (1947).

March 1953.

In XXIII

(Co I sequence; 27 electrons) $Z=49$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^9\ ^2D_{2/2}$

$3d^9\ ^2D_{2/2}$ K I. P. volts

This spectrum has not been analyzed, but Edlén has observed two lines due to the transition $3p^6\,3d^9\ ^2D$–$3p^5\,3d^{10}\ ^2P^\circ$, in the region between 40 A and 80 A. In figure 4 of his paper on the spectra of highly-ionized atoms, the observed wave numbers are plotted against atomic number for this combination in the Co I-like spectra Pd XX to Sn XXIV. For In XXIII the wave numbers are between 1700000 K and 2000000 K.

REFERENCE

B. Edlén, Physica 13, No. 9, 548 (1947).

March 1953.

TIN

Sn I

50 electrons $Z=50$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,5s^2\,5p^2\ {}^3P_0$

$5p^2\ {}^3P_0$ **59231.8 K** **I. P. 7.342 volts**

In 1940 Meggers published an extensive analysis of Sn I in which he revised the earlier work by Back, Green and Loring, and others. His observations extend from 2000 A to 13000 A, and are supplemented by corrected radiometric observations of Randall and Wright between 12788 A and 24738 A. Spectrograms taken by Shenstone cover the short-wave interval 1400 A to 2200 A. Meggers lists 378 lines between 1697.59 A and 24738 A, of which 80 percent are classified. Observed intersystem combinations connect the singlet and triplet systems of terms.

Garton has observed the Sn I spectrum in absorption from 1300 A to 1800 A. He reports the discovery of about 50 new atomic lines and states that analysis of this extension of Sn I is in progress.

Barrow and Rowlinson have recently extended the ultraviolet observations of Sn I and reported a number of series lines above the ionization limit. All but nine levels in the table higher than 59453 are from their list. Owing to the difficulty of fitting these new series on to the known series, the writer submitted these data to Shenstone with the hope that he might be able to interpret them. This he has been able to do by means of a new spectrogram in the Schumann region connecting the separate regions of the spectrum. The present analysis is from his manuscript, prepared especially for inclusion here. He has made some revisions to Meggers' analysis and classified about one hundred additional lines. The limits quoted in the table are based chiefly on the series by Barrow and Rowlinson, the strongest ones being $nd\ {}^1P_1^{\circ}$ ($n=8$ to 19) and $nd\ {}^3P_1^{\circ}$ ($n=8$ to 27). Meggers derived the limit 59155.0K from the $ns\ {}^3P^{\circ}$ series ($n=6$ to 15) and $ns\ {}^1P^{\circ}$ series ($n=6$ to 8), by means of a Ritz formula.

The ground term of Sn II, $5p\ {}^2P^{\circ}$, has an interval of 4251K. As a consequence of this wide interval, the levels of a given configuration in Sn I having this term as limit, divide themselves into two widely separated groups, the lower of which has as limit $5p\ {}^2P^{\circ}_{0\frac{1}{2}}$, and the higher has the limit $5p\ {}^2P^{\circ}_{1\frac{1}{2}}$. The J-values of the limit are quoted in the table so that the related pairs of levels can be distinguished. The Jl-coupling notation can be worked out from the auxiliary table that precedes the references below.

Back, and Green and Loring have observed the Zeeman effect for Sn I lines. Their results are in good agreement. The g-values in the table are chiefly from Back's paper. Some g-values of Sn I lines, measured as impurity lines by W. F. Meggers, C. C. Kiess, and C. J. Humphreys on spectrograms at the National Bureau of Standards, have been averaged with those of Back. This applies only to the levels of the $5p^2$- and $6s$-configurations.

In these Volumes the general format is to arrange the levels by terms. Shenstone emphasizes strongly that in the case of Sn I this is particularly misleading. In compliance with his urgent request, an exception is being made for Sn I, and the levels are repeated in a Supplementary Table in numerical order over the range in which overlapping occurs.

Sn I—Continued

Author	Config.	Desig.	J	Author	Config.	Desig.	J
$ns\ ^3P^\circ_0$	$5p(^2P^\circ_{1/2})ns$	$ns\ [0\frac{1}{2}]^\circ$	0	$nd\ ^3F^\circ_2$	$5p(^2P^\circ_{1/2})nd$	$nd\ [1\frac{1}{2}]^\circ$	2
$^3P^\circ_1$			1	$^3D^\circ_1$			1
$ns\ ^3P^\circ_2$	$5p(^2P^\circ_{1\frac{1}{2}})ns$	$ns'\ [1\frac{1}{2}]^\circ$	2	$nd\ ^3D^\circ_2$	″	$nd\ [2\frac{1}{2}]^\circ$	2
$^1P^\circ_1$			1	$^3D^\circ_3$			3
$np\ ^3P_1$	$5p(^2P^\circ_{1/2})np$	$np\ [0\frac{1}{2}]$	1	$nd\ ^1D^\circ_2$	$5p(^2P^\circ_{1\frac{1}{2}})nd$	$nd'\ [2\frac{1}{2}]^\circ$	2
$^3P_0$			0	$^3F^\circ_3$			3
$np\ ^3D_2$	″	$np\ [1\frac{1}{2}]$	2	$nd\ ^3P^\circ_2$	″	$nd'\ [1\frac{1}{2}]^\circ$	2
$^3D_1$			1	$^3P^\circ_1$			1
$np\ ^1P_1$	$5p(^2P^\circ_{1\frac{1}{2}})np$	$np'\ [0\frac{1}{2}]$	1	$nd\ ^3P^\circ_0$	″	$nd'\ [0\frac{1}{2}]^\circ$	0
$^1S_0$			0	$^1P^\circ_1$			1
$np\ ^3D_3$	″	$np'\ [2\frac{1}{2}]$	3	$nd\ ^3F^\circ_4$	″	$nd'\ [3\frac{1}{2}]^\circ$	4
$^3P_2$			2	$^1F^\circ_3$			3
$np\ ^3S_1$	″	$np'\ [1\frac{1}{2}]$	1				
$^1D_2$			2				

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W. F. Meggers, J. Research Nat. Bur. Std. **24**, 153, RP 1275 (1940). (I P) (T) (C L)
W. R. S. Garton, Nature **166**, 690 (1950); Proc. Phys. Soc. London [A] **64**, 591 (1951). (T)
P. F. A. Klinkenberg, Rev. Mod. Phys. **24**, No. 2, 63 (1952). (Summary hfs)
R. F. Barrow and H. C. Rowlinson, unpublished material (Nov. 1953). (T) (C L)
H. E. Walchli, *A Table of Nuclear Moment Data*, Oak Ridge Nat. Lab., ORNL–1469, Suppl. II, 29 (1955). (Summary hfs)
A. G. Shenstone, unpublished material (June 1956). (I P) (T) (C L)

Sn I

Config.	Desig.	J	Level	Interval	Obs. g
$5s^2\ 5p^2$	$5p^2\ ^3P$	0	0.0	1691.8	0/0
		1	1691.8	1735.9	1.502
		2	3427.7		1.452
$5s^2\ 5p^2$	$5p^2\ ^1D$	2	8613.0		1.052
$5s^2\ 5p^2$	$5p^2\ ^1S$	0	17162.6		0/0
$5s^2\ 5p(^2P^\circ_{1/2})6s$	$6s\ ^3P^\circ$	0	*34640.8*	273.4	0/0
″		1	*34914.2*	3714.6	1.380
$5s^2\ 5p(^2P^\circ_{1\frac{1}{2}})6s$		2	*38628.8*		1.501
$5s^2\ 5p(^2P^\circ_{1\frac{1}{2}})6s$	$6s\ ^1P^\circ$	1	*39257.1*		1.121
$5s\ 5p^3$	$5p^3\ ^5S^\circ$	2	*39625.5*		
$5s^2\ 5p(^2P^\circ_{1/2})6p$	$6p\ ^3P$	0	43430.0	−1087.7	
″		1	42342.3	4892.9	
$5s^2\ 5p(^2P^\circ_{1\frac{1}{2}})6p$		2	47235.2		
$5s^2\ 5p(^2P^\circ_{1/2})6p$	$6p\ ^3D$	1	43368.5	−129.8	
″		2	43238.7	3768.1	
$5s^2\ 5p(^2P^\circ_{1\frac{1}{2}})6p$		3	47006.8		
$5s^2\ 5p(^2P^\circ_{1/2})5d$	$5d\ ^3F^\circ$	2	*43683.0*	3805.0	0.865
$5s^2\ 5p(^2P^\circ_{1\frac{1}{2}})5d$		3	*47488.0*		1.246
		4			
$5s^2\ 5p(^2P^\circ_{1/2})5d$	$5d\ ^3D^\circ$	1	*44508.8*	−364.2	0.635
″		2	*44144.6*	431.5	1.131
″		3	*44576.1*		1.167

Config.	Desig.	J	Level	Interval	Obs. g
$5s^2\ 5p(^2P^\circ_{1\frac{1}{2}})6p$	$6p\ ^1P$	1	46603.4		
$5s^2\ 5p(^2P^\circ_{1\frac{1}{2}})6p$	$6p\ ^1S$	0	46936.3?		
$5s^2\ 5p(^2P^\circ_{1\frac{1}{2}})5d$	$5d\ ^1D^\circ$	2	*47145.7*		0.941
$5s^2\ 5p(^2P^\circ_{1\frac{1}{2}})6p$	$6p\ ^3S$	1	47805.7		
$5s^2\ 5p(^2P^\circ_{1\frac{1}{2}})6p$	$6p\ ^1D$	2	48189.7		
$5s^2\ 5p(^2P^\circ_{1/2})7s$	$7s\ ^3P^\circ$	0	*48216.2*	5.9	
″		1	*48222.1*	4193.6	1.316
$5s^2\ 5p(^2P^\circ_{1\frac{1}{2}})7s$		2	*52415.7*		
$5s^2\ 5p(^2P^\circ_{1\frac{1}{2}})5d$	$5d\ ^3P^\circ$	2	*48669.6*	−312.4	1.406
″		1	*48982.0*	−505.2	1.229
″		0	*49487.2*		
$5s^2\ 5p(^2P^\circ_{1\frac{1}{2}})5d$	$5d\ ^1F^\circ$	3	*49893.8*		1.043
$5s^2\ 5p(^2P^\circ_{1\frac{1}{2}})5d$	$5d\ ^1P^\circ$	1	*50125.9*		1.066
$5s^2\ 5p(^2P^\circ_{1/2})7p$	$7p\ ^3P$	0	51374.8	−619.0	
″		1	50755.8	4431.1	
$5s^2\ 5p(^2P^\circ_{1\frac{1}{2}})7p$		2	55186.9		
$5s^2\ 5p(^2P^\circ_{1/2})6d$	$6d\ ^3D^\circ$	1	*51475.1*	−464.6	0.863
″		2	*51010.5*	744.4	
″		3	*51754.9*		
$5s^2\ 5p(^2P^\circ_{1/2})7p$	$7p\ ^3D$	1	51113.3	57.5	
″		2	51170.8	3969.1	
$5s^2\ 5p(^2P^\circ_{1\frac{1}{2}})7p$		3	55139.9		

Sn I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$5s^2\,5p(^2P_{\frac{1}{2}})6d$ $5s^2\,5p(^2P_{1\frac{1}{2}})6d$	$6d\ ^3F^\circ$	2 3 4	*51160.2* *55739.7*	4579.5	
$5s^2\,5p(^2P_{\frac{1}{2}})4f$		2?	52249.0		
$5s^2\,5p(^2P_{\frac{1}{2}})4f$		2	52263.8		
$5s^2\,5p(^2P_{1\frac{1}{2}})7p$	$7p\ ^3S$	0	52265.3		
$5s^2\,5p(^2P_{1\frac{1}{2}})7s$	$7s\ ^1P^\circ$	1	*52706.8*		
$5s^2\,5p(^2P_{\frac{1}{2}})8s$ $5s^2\,5p(^2P_{1\frac{1}{2}})8s$	$8s\ ^3P^\circ$	0 1 2	 *53080.6* *57149.8*	4129.2	
$5s^2\,5p(^2P_{\frac{1}{2}})7d$ " "	$7d\ ^3D^\circ$	1 2 3	*53592.2* *53631.4* *53826.0*	39.2 194.6	
$5s^2\,5p(^2P_{\frac{1}{2}})7d$ $5s^2\,5p(^2P_{1\frac{1}{2}})7d$	$7d\ ^3F^\circ$	2 3 4	*54211.7* *59190.2*	4978.5	
$5s^2\,5p(^2P_{1\frac{1}{2}})6d$ " "	$6d\ ^3P^\circ$	2 1 0	*54653.4* *55074.0* *55782.4*	−420.6 −708.4	
$5s^2\,5p(^2P_{\frac{1}{2}})8d$ " "	$8d\ ^3D^\circ$	1 2 3	*54712.8?* *55130.9?* *54830.5*	418.1 −300.4	
$5s^2\,5p(^2P_{\frac{1}{2}})5f$		3?	54762.6		
$5s^2\,5p(^2P_{\frac{1}{2}})5f$		2?	54767.7		
$5s^2\,5p(^2P_{\frac{1}{2}})5f$		2?	54771.8		
$5s^2\,5p(^2P_{1\frac{1}{2}})7p$	$7p\ ^1P$	1	54990.0		
$5s^2\,5p(^2P_{\frac{1}{2}})9s$ $5s^2\,5p(^2P_{1\frac{1}{2}})9s$	$9s\ ^3P^\circ$	0 1 2	 *55156.0* *59375.9*	4219.9	
$5s^2\,5p(^2P_{1\frac{1}{2}})6d$	$6d\ ^1D^\circ$	2	*55296.1*		
$5s^2\,5p(^2P_{1\frac{1}{2}})7p$	$7p\ ^3S$	1	55373.8		
$5s^2\,5p(^2P_{1\frac{1}{2}})7p$	$7p\ ^1D$	2	55500.6		
$5s\ 5p^3$	$5p^3\ ^3S^\circ$	1	*55657.4*		
$5s^2\,5p(^2P_{\frac{1}{2}})8d$ $5s^2\,5p(^2P_{1\frac{1}{2}})8d$	$8d\ ^3F^\circ$	2 3 4	*55803.2* *60450.0*	4646.8	
$5s^2\,5p(^2P_{1\frac{1}{2}})6d$	$6d\ ^1P^\circ$	1	*56244.0*		
$5s^2\,5p(^2P_{1\frac{1}{2}})6d$	$6d\ ^1F^\circ$	3	*56298.8*		
		1 or 2	56357.4		
$5s^2\,5p(^2P_{\frac{1}{2}})10s$ $5s^2\,5p(^2P_{1\frac{1}{2}})10s$	$10s\ ^3P^\circ$	0 1 2	 *56389.2* *60598.8*	4209.6	
$5s^2\,5p(^2P_{1\frac{1}{2}})4f$		2?	56396.0		
$5s^2\,5p(^2P_{1\frac{1}{2}})4f$		3?	56400.7		
$5s^2\,5p(^2P_{1\frac{1}{2}})4f$		2	56486.5		
$5s^2\,5p(^2P_{1\frac{1}{2}})4f$		1?	56488.5		
$5s\ 5p^3$	$5p^3\ ^3D^\circ$	1 2 3	*56658.0* *56544.8* *57181.6*	−113.2 636.8	

Sn I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$5s^2\,5p(^2P_{1\frac{1}{2}})4f$		3?	56550.0		
$5s^2\,5p(^2P_{1\frac{1}{2}})4f$	^3D	1	56632.9		
$5s^2\,5p(^2P_{1\frac{1}{2}})7d$	$7d\ ^1F^\circ$?	3	*56839.4*		
$5s^2\,5p(^2P_{\frac{1}{2}})11s$	$11s\ ^3P^\circ$	0 1 2	*57094.5*		
$5s^2\,5p(^2P_{\frac{1}{2}})9d$	$9d\ ^3D^\circ$	1 2 3	*57105.7*		
$5s^2\,5p(^2P_{1\frac{1}{2}})8s$	$8s\ ^1P^\circ$	1	*57282.3*		
$5s^2\,5p(^2P_{\frac{1}{2}})10d$	$10d\ ^3D^\circ$	1 2 3	*57533.7*		
$5s^2\,5p(^2P_{\frac{1}{2}})12s$	$12s\ ^3P^\circ$	0 1 2	*57563.0*		
$5s^2\,5p(^2P_{\frac{1}{2}})11d$ "	$11d\ ^3D^\circ$	1 2 3	 *57856.3* *57847.0?*	−9.3	
$5s^2\,5p(^2P_{\frac{1}{2}})13s$	$13s\ ^3P^\circ$	0 1 2	*57899.0*		
$5s^2\,5p(^2P_{1\frac{1}{2}})7d$	$7d\ ^3P^\circ$	2 1 0	*57934.7*		
$5s^2\,5p(^2P_{\frac{1}{2}})12d$	$12d\ ^3D^\circ$	1 2 3	*58100.9*		
$5s^2\,5p(^2P_{\frac{1}{2}})14s$	$14s\ ^3P^\circ$	0 1 2	*58143.6*		
$5s^2\,5p(^2P_{\frac{1}{2}})15s$	$15s\ ^3P^\circ$	0 1 2	*58324.3*		
$5s^2\,5p(^2P_{\frac{1}{2}})16s$	$16s\ ^3P^\circ$	0 1 2	*58523.3*		
$5s^2\,5p(^2P_{\frac{1}{2}})15d$	$15d\ ^3D^\circ$	1 2 3	*58595.0*		
$5s^2\,5p(^2P_{\frac{1}{2}})17s$	$17s\ ^3P^\circ$	0 1 2	*58607.5*		
$5s^2\,5p(^2P_{\frac{1}{2}})16d$	$16d\ ^3D^\circ$	1 2 3	*58679.6*		
$5s^2\,5p(^2P_{\frac{1}{2}})18s$	$18s\ ^3P^\circ$	0 1 2	*58690.0*		
$5s^2\,5p(^2P_{\frac{1}{2}})17d$	$17d\ ^3D^\circ$	1 2 3	*58747.8*		
$5s^2\,5p(^2P_{\frac{1}{2}})19s$	$19s\ ^3P^\circ$	0 1 2	*58758.4*		
$5s^2\,5p(^2P_{1\frac{1}{2}})7d$	$7d\ ^1P^\circ$	1	*58970.3*		

Sn I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$5s^2\,5p(^2P^\circ_{\frac{1}{2}})5f$		3?	59046.6		
Sn II ($^2P^\circ_{\frac{1}{2}}$)	*Limit*	----	59231.8		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})9s$	$9s\ ^1P^\circ$	1	*59458.0*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})8d$	$8d\ ^3P^\circ$	1	*60051.4*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})8d$	$8d\ ^1P^\circ$	1	*60397.0*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})9d$	$9d\ ^3P^\circ$	1	*60948.4*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})9d$	$9d\ ^1P^\circ$	1	*61212.2*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})9d$	$9d\ ^3F^\circ$	3	*61247.5*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})10d$	$10d\ ^1D^\circ$	2	*61534.2*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})10d$	$10d\ ^3P^\circ$	1	*61556.3*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})10d$	$10d\ ^1P^\circ$	1	*61744.8*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})10d$	$10d\ ^3F^\circ$	3	*61768.0*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})12s$	$12s\ ^1P^\circ$	1	*61859.5*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})11d$	$11d\ ^1D^\circ$	2	*61963.0*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})11d$	$11d\ ^3P^\circ$	1	*61973.2*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})11d$	$11d\ ^1P^\circ$	1	*62110.6*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})11d$	$11d\ ^3F^\circ$	3	*62127*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})13s$	$13s\ ^1P^\circ$	1	*62191.5*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})12d$	$12d\ ^1D^\circ$	2	*62263.9*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})12d$	$12d\ ^3P^\circ$	1	*62267.3*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})12d$	$12d\ ^1P^\circ$	1	*62373.3*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})12d$	$12d\ ^3F^\circ$	3	*62385*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})14s$	$14s\ ^1P^\circ$	1	*62431.0*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})13d$	$13d\ ^1D^\circ$	2	*62483.1*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})13d$	$13d\ ^3P^\circ$	1	*62484.0*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})13d$	$13d\ ^1P^\circ$	1	*62564.5*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})15s$	$15s\ ^1P^\circ$	1	*62609.4*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})14d$	$14d\ ^1D^\circ$	2	*62647.8*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})14d$	$14d\ ^3P^\circ$	1	*62651.8*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})14d$	$14d\ ^1P^\circ$	1	*62716.4*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})16s$	$16s\ ^1P^\circ$	1	*62745.9*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})15d$	$15d\ ^1D^\circ$	2	*62774.6*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})15d$	$15d\ ^3P^\circ$	1	*62776.2*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})15d$	$15d\ ^1P^\circ$	1	*62827.5*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})17s$	$17s\ ^1P^\circ$	1	*62852.6*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})16d$	$16d\ ^1D^\circ$	2	*62871.2*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})16d$	$16d\ ^3P^\circ$	1	*62878.1*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})16d$	$16d\ ^1P^\circ$	1	*62919.6*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})17d$	$17d\ ^1D^\circ$	2	*62954.2*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})17d$	$17d\ ^3P^\circ$	1	*62956.4*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})17d$	$17d\ ^1P^\circ$	1	*62992.5*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})18d$	$18d\ ^1D^\circ$	2	*63018.1*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})18d$	$18d\ ^3P^\circ$	1	*63025.9*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})18d$	$18d\ ^1P^\circ$	1	*63051.3*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})19d$	$19d\ ^1D^\circ$	2	*63072.6*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})19d$	$19d\ ^3P^\circ$	1	*63080.3*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})19d$	$19d\ ^1P^\circ$	1	*63104.2*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})20d$	$20d\ ^3P^\circ$	1	*63122.5*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})21d$	$21d\ ^3P^\circ$	1	*63160.4*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})22d$	$22d\ ^3P^\circ$	1	*63191.6*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})23d$	$23d\ ^3P^\circ$	1	*63220.7*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})24d$	$24d\ ^3P^\circ$	1	*63244.3*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})25d$	$25d\ ^3P^\circ$	1	*63267.9*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})26d$	$26d\ ^3P^\circ$	1	*63283.5*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})27d$	$27d\ ^3P^\circ$	1	*63297.5*		
Sn II ($^2P^\circ_{1\frac{1}{2}}$)	*Limit*	----	63483.2		

July 1956.

Sn I—Supplementary Table

Config.	Desig.	J	Level	Config.	Desig.	J	Level
$5s^2\,5p^2$	$5p^2\ ^3P$	0	0.0	$5s^2\,5p(^2P_{\frac{1}{2}})6d$	$6d\ ^3F^\circ$	2	*51160.2*
"	$5p^2\ ^3P$	1	1691.8	$5s^2\,5p(^2P_{\frac{1}{2}})7p$	$7p\ ^3D$	2	51170.8
"	$5p^2\ ^3P$	2	3427.7	"	$7p\ ^3P$	0	51374.8
"	$5p^2\ ^1D$	2	8613.0	$5s^2\,5p(^2P_{\frac{1}{2}})6d$	$6d\ ^3D^\circ$	1	*51475.1*
"	$5p^2\ ^1S$	0	17162.6	$5s^2\,5p(^2P_{\frac{1}{2}})6d$	$6d\ ^3D^\circ$	3	*51754.9*
$5s^2\,5p(^2P_{\frac{1}{2}})6s$	$6s\ ^3P^\circ$	0	*34640.8*	$5s^2\,5p(^2P_{\frac{1}{2}})4f$		2?	52249.0
"	$6s\ ^3P^\circ$	1	*34914.2*	"		2	52263.8
$5s^2\,5p(^2P_{1\frac{1}{2}})6s$	$6s\ ^3P^\circ$	2	*38628.8*	$5s^2\,5p(^2P_{1\frac{1}{2}})7p$	$7p\ ^1S$	0	52265.3
"	$6s\ ^1P^\circ$	1	*39257.1*	$5s^2\,5p(^2P_{1\frac{1}{2}})7s$	$7s\ ^3P^\circ$	2	*52415.7*
$5s\ 5p^3$	$5p^3\ ^5S^\circ$	2	*39625.5*	"	$7s\ ^1P^\circ$	1	*52706.8*
$5s^2\,5p(^2P_{\frac{1}{2}})6p$	$6p\ ^3P$	1	42342.3	$5s^2\,5p(^2P_{\frac{1}{2}})8s$	$8s\ ^3P^\circ$	1	*53090.6*
"	$6p\ ^3D$	2	43238.7	$5s^2\,5p(^2P_{\frac{1}{2}})7d$	$7d\ ^3D^\circ$	1	*53592.2*
"	$6p\ ^3D$	1	43368.5	"	$7d\ ^3D^\circ$	2	*53631.4*
"	$6p\ ^3P$	0	43430.0	"	$7d\ ^3D^\circ$	3	*53826.0*
$5s^2\,5p(^2P_{\frac{1}{2}})5d$	$5d\ ^3F^\circ$	2	*43683.0*	"	$7d\ ^3F^\circ$	2	*54211.7*
"	$5d\ ^3D^\circ$	2	*44144.6*	$5s^2\,5p(^2P_{1\frac{1}{2}})6d$	$6d\ ^3P^\circ$	2	*54653.4*
"	$5d\ ^3D^\circ$	1	*44508.8*	$5s^2\,5p(^2P_{\frac{1}{2}})8d$	$8d\ ^3D^\circ$?	1	*54712.8*
"	$5d\ ^3D^\circ$	3	*44576.1*	$5s^2\,5p(^2P_{\frac{1}{2}})5f$		3?	54762.6
$5s^2\,5p(^2P_{1\frac{1}{2}})6p$	$6p\ ^1P$	1	46603.4	"		2?	54767.7
"	$6p\ ^1S$	0	46936.3?	"		2?	54771.8
"	$6p\ ^3D$	3	47006.8	$5s^2\,5p(^2P_{\frac{1}{2}})8d$	$8d\ ^3D^\circ$	3	*54830.5*
$5s^2\,5p(^2P_{1\frac{1}{2}})5d$	$5d\ ^1D^\circ$	2	*47145.7*	$5s^2\,5p(^2P_{1\frac{1}{2}})7p$	$7p\ ^1P$	1	54990.0
$5s^2\,5p(^2P_{1\frac{1}{2}})6p$	$6p\ ^3P$	2	47235.2	$5s^2\,5p(^2P_{1\frac{1}{2}})6d$	$6d\ ^3P^\circ$	1	*55074.0*
$5s^2\,5p(^2P_{1\frac{1}{2}})5d$	$5d\ ^3F^\circ$	3	*47488.0*	$5s^2\,5p(^2P_{\frac{1}{2}})8d$	$8d\ ^3D^\circ$	2	*55130.9*?
$5s^2\,5p(^2P_{1\frac{1}{2}})6p$	$6p\ ^3S$	1	47805.7	$5s^2\,5p(^2P_{1\frac{1}{2}})7p$	$7p\ ^3D$	3	55139.9
"	$6p\ ^1D$	2	48189.7	$5s^2\,5p(^2P_{\frac{1}{2}})9s$	$9s\ ^3P^\circ$	1	*55156.0*
$5s^2\,5p(^2P_{\frac{1}{2}})7s$	$7s\ ^3P^\circ$	0	*48216.2*	$5s^2\,5p(^2P_{1\frac{1}{2}})7p$	$7p\ ^3P$	2	55186.9
"	$7s\ ^3P^\circ$	1	*48222.1*	$5s^2\,5p(^2P_{1\frac{1}{2}})6d$	$6d\ ^1D^\circ$	2	*55296.1*
$5s^2\,5p(^2P_{1\frac{1}{2}})5d$	$5d\ ^3P^\circ$	2	*48669.6*	$5s^2\,5p(^2P_{1\frac{1}{2}})7p$	$7p\ ^3S$	1	55373.8
"	$5d\ ^3P^\circ$	1	*48982.0*	"	$7p\ ^1D$	2	55500.6
"	$5d\ ^3P^\circ$	0	*49487.2*	$5s\ 5p^3$	$5p^3\ ^3S^\circ$	1	*55687.4*
"	$5d\ ^1F^\circ$	3	*49893.8*	$5s^2\,5p(^2P_{1\frac{1}{2}})6d$	$6d\ ^3F^\circ$	3	*55739.7*
"	$5d\ ^1P^\circ$	1	*50125.9*	"	$6d\ ^3P^\circ$	0	*55782.4*
$5s^2\,5p(^2P_{\frac{1}{2}})7p$	$7p\ ^3P$	1	50755.8	$5s^2\,5p(^2P_{\frac{1}{2}})8d$	$8d\ ^3F^\circ$	2	*55803.2*
$5s^2\,5p(^2P_{\frac{1}{2}})6d$	$6d\ ^3D^\circ$	2	*51010.5*	$5s^2\,5p(^2P_{1\frac{1}{2}})6d$	$6d\ ^1P^\circ$	1	*56244.0*
$5s^2\,5p(^2P_{\frac{1}{2}})7p$	$7p\ ^3D$	1	51113.3	"	$6d\ ^1F^\circ$	3	*56298.8*

Sn I—Supplementary Table—Continued

Config.	Desig.	J	Level
		1 or 2	56357.4
$5s^2\,5p(^2P^\circ_{1/2})10s$	$10s\ ^3P^\circ$	1	*56389.2*
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})4f$		2?	56396.0
″		3?	56400.7
″		2	56486.5
″		1?	56488.5
$5s\ 5p^3$	$5p^3\ ^3D^\circ$	2	*56544.8*
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})4f$		3?	56550.0
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})4f$	^3D	1	56632.9
$5s\ 5p^3$	$5p^3\ ^3D^\circ$	1	*56658.0*
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})7d$	$7d\ ^1F^\circ$?	3	*56839.4*
$5s^2\,5p(^2P^\circ_{1/2})11s$	$11s\ ^3P^\circ$	1	*57094.5*
$5s^2\,5p(^2P^\circ_{1/2})9d$	$9d\ ^3D^\circ$	2	*57105.7*
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})8s$	$8s\ ^3P^\circ$	2	*57149.8*
$5s\ 5p^3$	$5p^3\ ^3D^\circ$	3	*57181.6*
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})8s$	$8s\ ^1P^\circ$	1	*57282.3*
$5s^2\,5p(^2P^\circ_{1/2})10d$	$10d\ ^3D^\circ$	2	*57533.7*
$5s^2\,5p(^2P^\circ_{1/2})12s$	$12s\ ^3P^\circ$	1	*57563.0*
$5s^2\,5p(^2P^\circ_{1/2})11d$	$11d\ ^3D^\circ$	3	*57847.0?*
″	$11d\ ^3D^\circ$	2	*57856.3*
$5s^2\,5p(^2P^\circ_{1/2})13s$	$13s\ ^3P^\circ$	1	*57899.0*
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})7d$	$7d\ ^3P^\circ$	1	*57934.7*
$5s^2\,5p(^2P^\circ_{1/2})12d$	$12d\ ^3D^\circ$	2	*58100.9*
$5s^2\,5p(^2P^\circ_{1/2})14s$	$14s\ ^3P^\circ$	1	*58143.6*
$5s^2\,5p(^2P^\circ_{1/2})15s$	$15s\ ^3P^\circ$	1	*58324.3*
$5s^2\,5p(^2P^\circ_{1/2})16s$	$16s\ ^3P^\circ$	1	*58523.3*
$5s^2\,5p(^2P^\circ_{1/2})15d$	$15d\ ^3D^\circ$	1	*58595.0*
$5s^2\,5p(^2P^\circ_{1/2})17s$	$17s\ ^3P^\circ$	1	*58607.5*
$5s^2\,5p(^2P^\circ_{1/2})16d$	$16d\ ^3D^\circ$	1	*58679.6*
$5s^2\,5p(^2P^\circ_{1/2})18s$	$18s\ ^3P^\circ$	1	*58690.0*
$5s^2\,5p(^2P^\circ_{1/2})17d$	$17d\ ^3D^\circ$	1	*58747.8*
$5s^2\,5p(^2P^\circ_{1/2})19s$	$19s\ ^3P^\circ$	1	*58758.4*
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})7d$	$7d\ ^1P^\circ$	1	*58970.3*
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})5f$		3?	59046.6
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})7d$	$7d\ ^3F^\circ$	3	*59190.2*
Sn II ($^2P^\circ_{1/2}$)	*Limit*		**59231.3**
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})9s$	$9s\ ^3P^\circ$	2	*59375.9*
″	$9s\ ^1P^\circ$	1	*59453.0*
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})8d$	$8d\ ^3P^\circ$	1	*60051.4*
″	$8d\ ^1P^\circ$	1	*60397.0*
″	$8d\ ^3F^\circ$	3	*60450.0*
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})10s$	$10s\ ^3P^\circ$	2	*60598.8*

See remaining levels on page 77.

Sn I Observed Terms*

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}+$	Observed Terms		
$5s^2\,5p^2$	$5p^2\ ^1S$, $5p^2\ ^3P$, $5p^2\ ^1D$		
$5s\ 5p^3$	$5p^3\ ^5S^\circ$, $5p^3\ ^3S^\circ$, $5p^3\ ^3D^\circ$		
	$ns\ (n \geq 6)$	$np\ (n \geq 6)$	
$5s^2\,5p(^2P^\circ)nx$	6–19s $^3P^\circ$ 6–9, 12–17s $^1P^\circ$	6, 7p ^3S 6, 7p ^1S	6, 7p ^3P 6, 7p ^1P 6, 7p ^3D 6, 7p ^1D
	$nd\ (n \geq 5)$		
$5s^2\,5p(^2P^\circ)nx$	5–27d $^3P^\circ$ 5–19d $^1P^\circ$ 5–12, 15–17d $^3D^\circ$ 5, 6, 10–19d $^1D^\circ$ 5–12d $^3F^\circ$ 5–7?d $^1F^\circ$		

*For predicted terms in the spectra of the Sn I isoelectronic sequence, see Vol. III, Introduction.

(In I sequence; 49 electrons) $Z=50$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,5s^2\,5p\ ^2P^\circ_{0\frac{1}{2}}$

$5p\ ^2P^\circ_{0\frac{1}{2}}$ *118017.0* K I. P. 14.628 volts

In 1938 McCormick and Sawyer published an extension and revision of the earlier work on Sn II. Shenstone has recently reobserved the spectrum between 600 A and 2500 A, revised a number of their term values, carried the analysis further, and confirmed the 1938 value of the limit from a Ritz series calculation. There are approximately 145 classified lines in the interval 899 A to 7904 A. The doublet and quartet systems of terms are connected by observed intersystem combinations.

In the table, the energy-level values given to one decimal are from Shenstone, who furnished them in advance of publication for inclusion here. Previously identified levels not confirmed by his new observations because of the limited range, are given without a decimal.

Green and Loring observed the Zeeman effect for 8 Sn II lines. The *g*-values in the last column of the table have been derived by the writer from their observed patterns.

Shenstone comments that "the analysis is far from complete since it requires new observations with the hollow cathode, over the whole range of wavelengths". This is indicated by the miscellaneous levels in the table. He notes that those labeled 1°, 2° and 3° have the configuration $5s\,5p(^3P^\circ)6s$ or $5s\,5p(^3P^\circ)5d$.

REFERENCES

J. B. Green and R. A. Loring, Phys. Rev. **30**, 574 (1927). (C L) (Z E)
W. W. McCormick and R. A. Sawyer, Phys. Rev. **54**, 71 (1938). (I P) (T) (C L)
H. E. Walchli, *A Table of Nuclear Moment Data*, Oak Ridge Nat. Lab., ORNL–1469, 44 (1953). (Summary hfs)
W. R. S. Garton, Proc. Phys. Soc. London [A] **67**, 864 (1954). (T) (C L)
A. G. Shenstone, unpublished material (June 1955). (I P) (T) (C L)

Sn II

Config.	Desig.	J	Level	Interval
$5s^2(^1S)5p$	$5p\ ^2P^\circ$	0½ 1½	*0.0* *4251.4*	4251.4
$5s\,5p^2$	$5p^2\ ^4P$	0½ 1½ 2½	46464.2 48368.0 50730.0	1903.8 2362.0
$5s^2(^1S)6s$	$6s\ ^2S$	0½	56885.9	
$5s\,5p^2$?	$5p^2\ ^2D$	1½ 2½	58843.8 59463.4	619.6
$5s^2(^1S)5d$?	$5d\ ^2D$	1½ 2½	71405.6 72047.6	642.0
$5s^2(^1S)6p$	$6p\ ^2P^\circ$	0½ 1½	*71494.3* *72377.3*	883.0
$5s\,5p^2$	$5p^2\ ^2S$?	0½	80206.1	
$5s\,5p^2$	$5p^2\ ^2P$?	0½ 1½	80455.3 81718.0	1262.7
$5s^2(^1S)7s$	$7s\ ^2S$	0½	86280.2	
$5s^2(^1S)4f$	$4f\ ^2F^\circ$	3½ 2½	*89286* *89292*	−6
$5s^2(^1S)6d$	$6d\ ^2D$	1½ 2½	90242.1 90353.5	111.4
$5s^2(^1S)7p$	$7p\ ^2P^\circ$	0½ 1½	*91903* *92266*	363

Sn II—Continued

Config.	Desig.	J	Level	Interval
$5s^2(^1S)8s$	$8s\ ^2S$	0½	98402.1	
$5s^2(^1S)5f$	$5f\ ^2F^\circ$	3½ 2½	*99659* *99663*	−4
$5s^2(^1S)7d$	$7d\ ^2D$	1½ 2½	100284.6 100339.2	54.6
$5s^2(^1S)8p$	$8p\ ^2P^\circ$	0½ 1½	*101196* *101387*	191
$5s^2(^1S)9s$	$9s\ ^2S$	0½	104680.1	
$5s^2(^1S)6f$	$6f\ ^2F^\circ$	3½ 2½	*105367*	
$5s^2(^1S)8d$	$8d\ ^2D$	1½ 2½	105732.6 105764.3	31.7
$5s^2(^1S)6g$	$6g\ ^2G$	3½ 4½	} 105735	
$5s^2(^1S)9p$	$9p\ ^2P^\circ$	0½ 1½	 *106368*	
$5s^2(^1S)10s$	$10s\ ^2S$	0½	108354.1	
$5s^2(^1S)7g$	$7g\ ^2G$	3½ 4½	} 109000	
$5s^2(^1S)9d$	$9d\ ^2D$	1½ 2½	109007.3 109025.9	18.6
	$1^\circ\ (^4P^\circ?)$	0½?	*109233.4?*	
$5s\,5p(^3P^\circ)6s$	$6s'\ ^4P^\circ$	0½ 1½ 2½	*109455.5* *110778.2* *114245.7*	1322.7 3467.5
$5s^2(^1S)11s$	$11s\ ^2S$	0½	110695.2	
$5s^2(^1S)8g$	$8g\ ^2G$	3½ 4½	} 111118	
$5s^2(^1S)10d$	$10d\ ^2D$	1½ 2½	111128.3 111141.3	12.5

Sn II—Continued

Config.	Desig.	J	Level	Interval
$5s^2(^1S)9g$	$9g\ ^2G$	3½ 4½	} 112570	
$5s^2(^1S)11d$	$11d\ ^2D$	1½ 2½	 112597.8	
$5s^2(^1S)10g$	$10g\ ^2G$	3½ 4½	} 113607	
	$2^\circ\ (^2P^\circ?)$	1½?	*113819.0*	
$5s^2(^1S)11g$	$11g\ ^2G$	3½ 4½	} 114374	
....	....	....	....	
Sn III$(^1S_0)$	*Limit*	....	*118017.0*	
	3°	0½ or 1½	*119930.9?*	
	4°	0½ or 1½	*120063.8*	
	5°	1½ or 2½	*120253.6*	
	$6^\circ\ (^4D^\circ?)$	3½?	*122491.6*	
$5s\,5p(^3P^\circ)5d$	$7^\circ\ (^4P^\circ?)$	1½?	*123156.9*	
$5s\,5p(^3P^\circ)5d$	$8^\circ\ (^4P^\circ?)$	2½?	*124246.4?*	
$5s\,5p(^3P^\circ)5d$	$9^\circ\ (^2D^\circ?)$	1½?	*124627.7*	
$5s\,5p(^3P^\circ)5d$	$10^\circ\ (^2D^\circ?)$	1½?	*132168.0*	
$5s\,5p(^3P^\circ)5d$	11°	1½ or 2½	*132708.3*	

July 1955.

Sn II Observed Terms*

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}+$	Observed Terms		
$5s\,5p^2$	$5p^2\ ^2S$ $\quad$ $5p^2\ ^4P$ $5p^2\ ^2P$ $\quad$ $5p^2\ ^2D$		
	$ns\ (n\geq 6)$	$np\ (n\geq 5)$	$nd\ (n\geq 5)$
$5s^2(^1S)nx$	6–11$s\ ^2S$	5–9$p\ ^2P^\circ$	5–11$d\ ^2D$
$5s\,5p(^3P^\circ)nx'$	$6s'\ ^4P^\circ$		
	$nf\ (n\geq 4)$	$ng\ (n\geq 5)$	
$5s^2(^1S)nx$	4–6$f\ ^2F^\circ$	6–11$g\ ^2G$	

*For predicted terms in the spectra of the In I isoelectronic sequence, see Vol. III, Introduction.

Sn III

(Cd I sequence; 48 electrons) $Z=50$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,5s^2\;{}^1S_0$

$5s^2\;{}^1S_0$ **246020.0** K I. P. 30.49 volts

Shenstone has revised and extended the early analysis by Gibbs and Vieweg and others, and furnished the tabular data in advance of publication. There are now 125 classified lines between 614 A and 3963 A in his line list based on new observations of Sn III. He has derived the limit from the $ns\;{}^3S$ series by means of a Ritz formula. Observed intersystem combinations connect the singlet and triplet systems of terms.

REFERENCE

A. G. Shenstone, unpublished material (June 1955). (I P) (T) (C L)

Sn III

Config.	Desig.	J	Level	Interval
$5s^2$	$5s^2\;{}^1S$	0	0.0	
$5s(^2S)5p$	$5p\;{}^3P^\circ$	0	*53548.0*	
		1	*55196.4*	1648.4
		2	*59228.6*	4032.2
$5s(^2S)5p$	$5p\;{}^1P^\circ$	1	*79911.3*	
$5p^2$	$5p^2\;{}^3P$	0	127308.5	
		1	130119.6	2811.1
		2	134567.2	4447.6
$5p^2$	$5p^2\;{}^1D$	2	128204.7	
$5s(^2S)6s$	$6s\;{}^3S$	1	139637.9	
$5s(^2S)5d$	$5d\;{}^3D$	1	141321.5	
		2	141526.4	204.9
		3	141838.1	311.7
$5s(^2S)6s$	$6s\;{}^1S$	0	143590.8	
$5s(^2S)5d$	$5d\;{}^1D$	2	154115.5	
$5s(^2S)6p$	$6p\;{}^3P^\circ$	0	*159939.8*	
		1	*160215.4*	275.6
		2	*161438.4*	1223.0
$5s(^2S)6p$	$6p\;{}^1P^\circ$	1	*162725.1*	
$5s(^2S)4f$	$4f\;{}^3F^\circ$	2	*179306.8*	
		3	*179343.0*	36.2
		4	*179441.1*	98.1
$5s(^2S)4f$	$4f\;{}^1F^\circ$	3	*179702.2*	
$5s(^2S)7s$	$7s\;{}^3S$	1	186688.3	
$5s(^2S)7s$	$7s\;{}^1S$	0	187399.5?	
$5s(^2S)6d$	$6d\;{}^3D$	1	187915.7	
		2	187996.3	80.6
		3	188129.0	132.7
$5s(^2S)6d$	$6d\;{}^1D$	2	189689.9	
$5s(^2S)5g$	$5g\;{}^3G$	3	206110.3	
		4	206110.3	0.0
		5	206133.3	23.0
$5s(^2S)5g$	$5g\;{}^1G$	4	206125.7	
$5s(^2S)8s$	$8s\;{}^3S$	1	207956.9	
$5s(^2S)7d$	$7d\;{}^3D$	1	208647.4	
		2	208694.9	47.5
		3	208775.0	80.1
$5p(^2P^\circ)5d$	1°	2	*208731.6*	
$5s(^2S)7d$	$7d\;{}^1D$	2	209255.8?	
$5p(^2P^\circ)5d$	2°	2 or 3	*213840.7?*	
$5p(^2P^\circ)5d$	3°	1	*215613.0?*	
$5p(^2P^\circ)5d$	4°	1 or 2	*215856.4*	
$5p(^2P^\circ)5d$	$5d'\;{}^3P^\circ$	0		
		1	*216752.0*	
		2	*217619.4*	867.4
$5s(^2S)9s$	$9s\;{}^3S$	1	219504.3?	
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Sn IV $(^2S_{1/2})$	*Limit*	----	**246020.0**	

July 1955.

Sn IV

(Ag I sequence; 47 electrons) $Z=50$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 5s\ ^2S_{1/2}$

$5s\ ^2S_{1/2}$ 328550.0 K I. P. 40.72 volts

The analysis is by Shenstone, who has revised and extended the early work of Lang and others especially for inclusion here. He has reobserved the spectrum and has a total of 45 classified lines between 595 A and 4216 A. His discovery of the $4d^9\ 5s^2\ ^2D$ term is of special interest.

His value of the limit is based on a Ritz series calculation for the $ns\ ^2S$ series.

REFERENCE

A. G. Shenstone, unpublished material (June 1955). (I P) (T) (C L)

Sn IV

Config.	Desig.	J	Level	Interval
$4d^{10}(^1S)5s$	$5s\ ^2S$	0½	0.0	
$4d^{10}(^1S)5p$	$5p\ ^2P°$	0½ 1½	*69563.9* *76072.3*	6508.4
$4d^{10}(^1S)5d$	$5d\ ^2D$	1½ 2½	165304.7 165410.8	106.1
$4d^9\ 5s^2$	$5s^2\ ^2D$	2½ 1½	169233.6 177889.0?	−8655.4
$4d^{10}(^1S)6s$	$6s\ ^2S$	0½	174138.8	
$4d^{10}(^1S)6p$	$6p\ ^2P°$	0½ 1½	*197850.9* *200030.8*	2179.9
$4d^{10}(^1S)4f$	$4f\ ^2F°$	3½ 2½	*210257.7* *210318.2*	−60.5
$4d^{10}(^1S)6d$	$6d\ ^2D$	1½ 2½	234795.7 235127.7	332.0

Sn IV

Config.	Desig.	J	Level	Interval
$4d^{10}(^1S)7s$	$7s\ ^2S$	0½	237615.7	
$4d^{10}(^1S)5g$	$5g\ ^2G$	4½ 3½	258282.3 258282.7	−0.4
$4d^9\ 5s(^1D)5p$	$5p''\ ^2F°?$	2½ 3½	 *259876.3*	
$4d^9\ 5s(^1D)5p$	$5p''\ ^2D°?$	1½ 2½	 *260398.5*	
$4d^9\ 5s(^1D)5p$	$5p''\ ^2P°?$	0½ 1½	 *263718.5*	
Sn V ($^1S_0$)	*Limit*	------	328550	

July 1955.

Sn V

(Pd I sequence; 46 electrons) Z=50

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\;{}^1S_0$

$4d^{10}\;{}^1S_0$ 583000 K I. P. 72.3 volts

The analysis is by Shenstone, who has revised and extended the earlier work by Gibbs and White, and others. The new observations extend from 824A to 1535A and include 58 classified lines.

Shenstone has determined the limit from the *ns*-series by means of a Ritz formula with an assumed value of $a=0.312\times10^{-6}$.

Observed intersystem combinations connect the singlet and triplet systems of terms.

REFERENCES

R. C. Gibbs and H. E. White, Proc. Nat. Acad. Sci. 14, 345, 559 (1928). (T) (C L)
A. G. Shenstone, unpublished material (June 1955). (I P) (T) (C L)

Sn V

Config.	Desig.	J	Level	Interval
$4d^{10}$	$4d^{10}\;{}^1S$	0	0.0	
$4d^9(^2D)5s$	$5s\;{}^3D$	3 2 1	182578.8 185058.0 191202.0	−2479.2 −6144.0
$4d^9(^2D)5s$	$5s\;{}^1D$	2	193229.8	
$4d^9(^2D)5p$	$5p\;{}^3P^\circ$	2 1 0	*259372.1* *267996.0*	−8623.9
$4d^9(^2D)5p$	$5p\;{}^3F^\circ$	4 3 2	*268731.1* *262316.4* *273335.0*	6414.7 −11018.6
$4d^9(^2D)5p$	$5p\;{}^3D^\circ$	3 2 1	*274376.8* *269096.0* *281169.1*	5280.8 −12073.1
$4d^9(^2D)5p$	$5p\;{}^1P^\circ$	1	*276589.4*	

Sn V

Config.	Desig.	J	Level	Interval
$4d^9(^2D)5p$	$5p\;{}^1F^\circ$	3	*279244.7*	
$4d^9(^2D)5p$	$5p\;{}^1D^\circ$	2	*282618.7*	
$4d^9(^2D)5d$	1	2 or 3	374811.6?	
$4d^9(^2D)5d$	2	1 or 2	379050.0?	
$4d^9(^2D)6s$	$6s\;{}^3D$	3 2 1	380266.5 381403.4 389285.0	−1136.9 −7881.6
$4d^9(^2D)5d$	3	3 or 4	381226.3	
$4d^9(^2D)5d$	4	3 or 4	386584.7	
$4d^9(^2D)6s$	$6s\;{}^1D$	2	390233.4?	
Sn VI($^2D_{2\frac{1}{2}}$)	*Limit*	--------	583000	

July 1955.

Sn VI

(Rh I sequence; 45 electrons) $Z=50$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^9\;{}^2D_{2\frac{1}{2}}$

$4d^9\;{}^2D_{2\frac{1}{2}}$ K I. P. volts

The spectrum is very incompletely analyzed. The listed terms are from Green, who has classified 38 lines between 289.21 A and 326.43 A, from a study of the isoelectronic sequence. Observed combinations connect the doublet and quartet systems of terms. No series have been found in Sn VI. The spectrum should be reobserved.

REFERENCE

M. Green, Phys. Rev. 60, 117 (1941). (T) (C L)

Sn VI

Config.	Desig.	J	Level	Interval
$4d^9$	$4d^9\;{}^2D$	$2\frac{1}{2}$ $1\frac{1}{2}$	0 8715	−8715
$4d^8(^3F)5p$	$5p\;{}^4G^\circ$	$5\frac{1}{2}$ $4\frac{1}{2}$ $3\frac{1}{2}$ $3\frac{1}{2}$	 *315060*	
$4d^8(^3F)5p$	$5p\;{}^4F^\circ$	$4\frac{1}{2}$ $3\frac{1}{2}$ $2\frac{1}{2}$ $1\frac{1}{2}$	 *319857* *324925* *317581*	−5068 7344
$4d^8(^3F)5p$	$5p\;{}^2D^\circ$	$2\frac{1}{2}$ $1\frac{1}{2}$	*320718*	
$4d^8(^3F)5p$	$5p\;{}^2F^\circ$	$3\frac{1}{2}$ $2\frac{1}{2}$	*325277* *326712*	−1435
$4d^8(^3F)5p$	$5p\;{}^2G^\circ$	$4\frac{1}{2}$ $3\frac{1}{2}$	 *327322*	
$4d^8(^3P)5p$	$5p'\;{}^4P^\circ$	$2\frac{1}{2}$ $1\frac{1}{2}$ $0\frac{1}{2}$	*329131* *330098* *328807*	−967 1291
$4d^8(^1D)5p$	$5p''\;{}^2F^\circ$	$2\frac{1}{2}$ $3\frac{1}{2}$	*331356* *333868*	2512
$4d^8(^1D)5p$	$5p''\;{}^2P^\circ$	$0\frac{1}{2}$ $1\frac{1}{2}$	*334183* *334348*	165
$4d^8(^1D)5p$	$5p''\;{}^2D^\circ$	$2\frac{1}{2}$ $1\frac{1}{2}$	*335638* *336530*	−892
$4d^8(^3P)5p$	$5p'\;{}^4D^\circ$	$3\frac{1}{2}$ $2\frac{1}{2}$ $1\frac{1}{2}$ $0\frac{1}{2}$	*336678* *339859* *339443*	−3181 416
$4d^8(^3P)5p$	$5p'\;{}^2D^\circ$	$1\frac{1}{2}$ $2\frac{1}{2}$	*341729* *342861*	1132
$4d^8(^3P)5p$	$5p'\;{}^2P^\circ$	$1\frac{1}{2}$ $0\frac{1}{2}$	*344400* *350245*	−5845
$4d^8(^3P)5p$	$5p'\;{}^2S^\circ$	$0\frac{1}{2}$	*344883*	
$4d^8(^1G)5p$	$5p'''\;{}^2F^\circ$	$3\frac{1}{2}$ $2\frac{1}{2}$	*345770* *347021*	−1251

February 1956.

Sn VI Observed Terms*

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6+$	Observed Terms				
$4d^9$	$4d^9\;{}^2D$				
	$np\;(n\geq 5)$				
$4d^8(^3F)nx$			$5p\;{}^2D^\circ$	$5p\;{}^4F^\circ$ $5p\;{}^2F^\circ$	$5p\;{}^4G^\circ$ $5p\;{}^2G^\circ$
$4d^8(^3P)nx'$	$5p'\;{}^2S^\circ$	$5p'\;{}^4P^\circ$ $5p'\;{}^2P^\circ$	$5p'\;{}^4D^\circ$ $5p'\;{}^2D^\circ$		
$4d^8(^1D)nx''$		$5p''\;{}^2P^\circ$	$5p''\;{}^2D^\circ$	$5p''\;{}^2F^\circ$	
$4d^8(^1G)nx'''$				$5p'''\;{}^2F^\circ$	

*For predicted terms in the spectra of the Rh I isoelectronic sequence, see Vol. III, Introduction.

Sn XXII

(Cu I sequence; 29 electrons) $Z=50$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s\;{}^2S_{1/2}$

$4s\;{}^2S_{1/2}$ K I. P. volts

This spectrum has not been analyzed, but Edlén has observed the leading doublets from the $4s$–$5p$ and $4p$–$5d$ configurations from Pd XVIII to In XXI. In figure 3 of his paper on the spectra of highly-ionized atoms, the lines are indicated on the photograph of vacuum-spark spectra of these elements from 40 A to 80 A. He states that the doublets have been traced in this sequence, as far as Sb XXIII.

By analogy with Cu I the writer has assumed the ground state indicated above.

REFERENCE

B. Edlén, Physica **13**, No. 9, 549 (1947).

March 1953.

Sn XXIV

(Co I sequence; 27 electrons) $Z=50$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^9\;{}^2D_{2\frac{1}{2}}$

$3d^9\;{}^2D_{2\frac{1}{2}}$ K I. P. volts

This spectrum has not been analyzed, but Edlén has observed two lines due to the transition $3p^6\,3d^9\;{}^2D$–$3p^5\,3d^{10}\;{}^2P^\circ$, in the region between 40 A and 80 A. In figure 4 of his paper on the spectra of highly-ionized atoms, the observed wave numbers are plotted against atomic number for this combination in the Co I-like spectra Pd XX to Sn XXIV. For Sn XXIV the wave numbers are between 1800000 K and 2100000 K.

REFERENCE

B. Edlén, Physica **13**, No. 9, 548 (1947).

March 1953.

ANTIMONY

Sb I

51 electrons $Z=51$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 5s^2\ 5p^3\ {}^4S^{\circ}_{1\frac{1}{2}}$

$5p^3\ {}^4S^{\circ}_{1\frac{1}{2}}$ ***69700*** K I. P. 8.639 volts

The analysis is by Meggers and Humphreys, whose line list extends from 1388.91 A to 12466.75 A. They observed the region from 2000 A to 13000 A. For the short-wave region, 1300 A to 2000 A, Shenstone made the spectrograms at Princeton. Of the 466 Sb I lines recorded, seventy-four percent have been classified. The observed g-values are from Zeeman patterns observed by Löwenthal in 1929. The paper by Meggers and Humphreys includes an extensive history and bibliography covering the earlier work on Sb I.

Observed intersystem combinations connect the doublet and quartet systems of terms. "Since it is not possible to assign definite L-values" to all of the levels, many have been numbered and listed as miscellaneous. The numbers assigned by the authors are entered in column one of the table.

The limit is from the $ns\ {}^4P(n=6-9)$ and $ns\ {}^2P(n=6, 7)$ series, and has been derived by a Ritz formula.

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P. F. A. Klinkenberg, Rev. Mod. Phys. **24**, No. 2, 63 (1952). (Summary hfs)

H. E. Walchli, *A Table of Nuclear Moment Data*, Oak Ridge Nat. Lab., ORNL-1469, Suppl. II, 29 (1955). (Summary hfs)

Sb I

Authors	Config.	Desig.	J	Level	Interval	Obs. g
1°	$5s^2\ 5p^3$	$5p^3\ {}^4S^\circ$	1½	*0.0*		1.967
2° 3°	$5s^2\ 5p^3$	$5p^3\ {}^2D^\circ$	1½ 2½	*8512.1* *9854.1*	1342.0	0.880 1.205
4° 5°	$5s^2\ 5p^3$	$5p^3\ {}^2P^\circ$	0½ 1½	*16395.6* *18464.5*	2068.9	0.688 1.277
1 2 4	$5s^2\ 5p^2(^3P_0)6s$ $5s^2\ 5p^2(^3P_1)6s$ $5s^2\ 5p^2(^3P_2)6s$	$6s\ \ {}^4P$	0½ 1½ 2½	43249.4 45945.4 48332.5	2696.0 2387.1	2.332 1.713 1.547
3 5	$5s^2\ 5p^2(^3P_1)6s$ $5s^2\ 5p^2(^3P_2)6s$	$6s\ \ {}^2P$	0½ 1½	46991.1 49391.1	2400.0	1.004 1.277
6°			1½	*52612.5*		
6			2½	53443.3		
7			1½	53528.3		
7°			1½	*54196.9*		
8			2½	55120.7		
8°			1½	*55134.4*		
9			2½	55135.2		
9°				*55168.3*		
10 11	$5s^2\ 5p^2(^1D_2)6s$ "	$6s'\ {}^2D$	1½ 2½	55233.2 55728.3	495.1	0.991 1.277
10°			2½	*55252.4*		
11°			1½	*55864.8*		
12°			1½	*55993.8*		
12			1½	56152.1		1.302
13			0½	56699.0		
14			1½	56733.4		1.311
15				57287.2		
13°			2½	*57410.3*		
16 23 30	$5s^2\ 5p^2(^3P_0)7s$ $5s^2\ 5p^2(^3P_1)7s$ $5s^2\ 5p^2(^3P_2)7s$	$7s\ \ {}^4P$	0½ 1½ 2½	57597.3 60964.7 63516.6	3367.4 2551.9	
14°			1½	*58075.5*		
17			0½	58132.9		
15°			1½	*58589.5*		
16°			0½	*58652.9*		
18			1½	58746.6		
17°			2½	*58835.3*		
19			2½	58863.4		
20			0½	59737.9		

Sb I

Authors	Config.	Desig.	J	Level	Interval	Obs. g
21			2½	60404.1		
22			1½	60580.8		
18°			0½	*61000.0*		
24	$5s^2\ 5p^2(^3P_1)7s$	$7s\ \ {}^2P$	0½ 1½	61286.3		
25			2½	61631.2		
26			1½	61808.8		
27			2½	62502.2		
28 45	$5s^2\ 5p^2(^3P_0)8s$ $5s^2\ 5p^2(^3P_1)8s$ $5s^2\ 5p^2(^3P_2)8s$	$8s\ \ {}^4P$	0½ 1½ 2½	62960.0 66112.0 68652	3152.0 2539	
29			1½	63192.3		
31			2½	63649.6		
19°				*63660.4*		
32			0½	63826.4		
20°			0½	*63900.3*		
33			2½	64213.8		
34			1½	64221.4		
35			1½	64432.9		
21°			2½	*64512.3*		
36			2½	64514.2		
37			0½	64769.5		
38			0½	64843.2		
22°			2½	*64878.9*		
23°			3½	*64957.0*		
24°			1½	*64984.4*		
39			2½	65144.8		
40			1½	65243.0		
41			0½	65257.8		
42			1½	65404.2		
25°			2½	*65460.3*		
26°			3½	*65467.5*		
27°			2½	*65479.6*		
28°			2½	*65568.6*		
43	$5s^2\ 5p^2(^1S_0)6s$	$6s''\ {}^2S$	0½	65653.2		
44				66009.5		

Sb I—Continued

Authors	Config.	Desig.	J	Level	Interval	Obs. g
29°			$2\frac{1}{2}$	*66088.0*		
46			$0\frac{1}{2}$	66354.0		
47			$2\frac{1}{2}$	66536.0		
48			$3\frac{1}{2}$	66743.7		
49			$1\frac{1}{2}$	66828.6		
30°			$2\frac{1}{2}$	*66887.1*		
50			$3\frac{1}{2}$	66967.3		
51			$1\frac{1}{2}$	67052.6		
52			$0\frac{1}{2}$	67427.7		
53				67794.6		
54			$1\frac{1}{2}$	67840.3		

Sb I—Continued

Authors	Config.	Desig.	J	Level	Interval	Obs. g
55				68045.8		
31°			$0\frac{1}{2}$	*68069.9*		
56			$1\frac{1}{2}$	68141.5		
57				68349.0		
		$9s\ ^4P$	$0\frac{1}{2}$			
	$5s^2\ 5p^2(^3P_1)9s$		$1\frac{1}{2}$	68503	2586	
	$5s^2\ 5p^2(^3P_2)9s$		$2\frac{1}{2}$	71089		
58			$2\frac{1}{2}$	68991.0		
	Sb II $(^3P_0)$	*Limit*	----	*69700*		
59			$0\frac{1}{2}$	69898.3		
	$5s^2\ 5p^2(^1D_2)7s$	$7s'\ ^2D$	$1\frac{1}{2}$			
60	〃		$2\frac{1}{2}$	70880.3		

February 1955.

Sb I Observed Terms*

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}+$	Observed Terms		
$5s^2\ 5p^3$	$5p^3\ ^4S^\circ$	$5p^3\ ^2P^\circ$	$5p^3\ ^2D^\circ$
	$ns\ (n \geq 6)$		
$5s^2\ 5p^2(^3P)ns$		6–$9s\ ^4P$ $6,7s\ ^2P$	
$5s^2\ 5p^2(^1D)ns'$			$6,7s'\ ^2D$
$5s^2\ 5p^2(^1S)ns''$	$6s''\ ^2S$		

* For predicted terms in the spectra of the Sb I isoelectronic sequence, see Vol. III, Introduction.

Sb II

(Sn I sequence; 50 electrons) $Z=51$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,5s^2\,5p^2\;{}^3P_0$

$5p^2\;{}^3P_0$ 133327.5 K I. P. 16.5 volts

This spectrum should be observed over the entire range. A complete analysis based on homogeneous observations is needed. The leading multiplets have been found by Lang and Vestine. Two other papers on analysis, one by Krishnamurty, and one by Murakawa and Suwa extend the work, but the three term lists are discordant, and it is difficult to interpret existing data in such a way as to provide a satisfactory array of energy levels. The writer has prepared a line list from the wavelengths published by Lang and Vestine (691 A to 7343 A), and unpublished measurements by W. F. Meggers (1272 A to 8742 A). From this list she has made a multiplet array of all published levels, and revised all level values, but the lists are not in good agreement and the tolerance between observed and calculated wave numbers is inexcusably large.

With intensities and intervals as a guide, she has attempted to reallocate the levels whose published designations appear subject to question, into a term array that compares not too unfavorably with that of Sn I and with the second spectra of nitrogen, phosphorus, and arsenic.

Approximately 220 lines are classified. Eleven levels have been rejected as unreal; two odd levels *68410.2* ($J=1$ or 2), and *70160.9* ($J=1$ or 2) have also been omitted from the table, but may be real. It should be emphasized that most of the designation assignments of the higher levels are extremely tentative and require confirmation; in fact, some of the levels listed may be spurious.

Yamanouchi has made a theoretical study of 10 levels of Sb II from the list by Murakawa and Suwa. Eight are unchanged in the present list, but for two, namely, the level at 90353.8 K published as ${}^3P_1$ and one at 86051.9 K as ${}^1P_1$, the writer has changed the respective designations to $7p\;{}^3D_1$ and $6p\;{}^3P_1$. These changes are admittedly tentative.

Lang adopts the limit 150000 K derived from two singlet series of two members each, $6s\;{}^1P^\circ - np\;{}^1D$ and $6s\;{}^1P^\circ - np\;{}^1S$ ($n=5, 6$). This limit gives an ionization potential of 19 volts. The extrapolated value by Finkelnburg derived from a study of screening constants, 16.7 ±0.5, is probably more reliable. The limit quoted above is from the paper by Murakawa and Suwa.

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W. Finkelnburg and F. Stern, Phys. Rev. 77, 303 (1950). (I P)

Sb II

Config.	Desig.	J	Level	Interval
$5s^2\,5p^2$	$5p^2\ ^3P$	0 1 2	0.0 3055.0 5659.0	3055.0 2604.0
$5s^2\,5p^2$	$5p^2\ ^1D$	2	12789.8	
$5s^2\,5p^2$	$5p^2\ ^1S$	0	23005.0	
$5s\,5p^3$	$5p^3\ ^3D^\circ$	1 2 3	*66291.7* *66502.6* *67888.2*	210.9 1385.6
$5s^2\,5p(^2P_{1/2})6s$ $5s^2\,5p(^2P_{1/2})6s$	$6s\ ^3P^\circ$	0 1 2	*69136.9* *69535.1* *75274.5*	398.2 5739.4
$5s^2\,5p(^2P^\circ)5d$	$5d\ ^3D^\circ$	1 2 3	*72339.9*	
$5s^2\,5p(^2P_{1/2})6s$	$6s\ ^1P^\circ$	1	*75896.9*	
$5s\,5p^3$	$5p^3\ ^3P^\circ$	2 1 0	*76692.1* *77139.4*	−447.3
$5s\,5p^3$	$5p^3\ ^1D^\circ$	2	*78391.2*	
		1 or 2	82221.8	
$5s^2\,5p(^2P^\circ)6p$	$6p\ ^3D$	1 2 3	83825.8 86183.6 91583.2	2357.8 5399.6
		1	84316.9	
$5s^2\,5p(^2P^\circ)6p$	$6p\ ^3P$	0 1 2	86494.5 86051.9 91718.2	−442.6 5666.3
$5s^2\,5p(^2P^\circ)6p$	$6p\ ^1P$?	1	87831.0	
		1 or 2	89562.6	
		2	89626.2	
$5s^2\,5p(^2P^\circ)5d$	$5d\ ^1P^\circ$	1	*90332.9*	
$5s^2\,5p(^2P^\circ)7p$	$7p\ ^3D$	1 2 3	90353.8 90647.3	293.5
		1	90606.4	
$5s^2\,5p(^2P^\circ)7p$	$7p\ ^3P$	0 1 2	90896.9	
$5s^2\,5p(^2P^\circ)5d$	$5d\ ^3P^\circ$	0 1 2	*91390.2*	

Sb II

Config.	Desig.	J	Level	Interval
		1 or 2	92543.0	
$5s^2\,5p(^2P^\circ)6p$	$6p\ ^3S$	1	93000.9	
$5s^2\,5p(^2P^\circ)6p$	$6p\ ^1D$	2	93853.2	
$5s^2\,5p(^2P^\circ)6p$	$6p\ ^1S$	0	95211.1	
$5s^2\,5p(^2P^\circ)7p$	$7p\ ^1D$	2	95464.1	
$5s^2\,5p(^2P^\circ)7p$	$7p\ ^1S$	0	96910.9	
$5s^2\,5p(^2P_{1/2})7s$ $5s^2\,5p(^2P_{1/2})7s$	$7s\ ^3P^\circ$	0 1 2	*97636.4* *104724.9*	7088.5
$5s^2\,5p(^2P^\circ)8p$	$8p\ ^3D$	1 2 3	105268.3	
$5s^2\,5p(^2P^\circ)4f$	$4f\ ^3F$	2 3 4	105591.1 105470.2	−120.9
$5s^2\,5p(^2P^\circ)6d$	$6d\ ^3F^\circ$	2 3 4	*105915.2*	
$5s^2\,5p(^2P_{1/2})7s$	$7s\ ^1P^\circ$	1	*107463.3*	
$5s^2\,5p(^2P^\circ)8p$	$8p\ ^1D$	2	111266.3	
		1 or 2	*111579.6*	
$5s^2\,5p(^2P^\circ)6d$	$6d\ ^3D^\circ$	1 2 3	*111624.7*	
$5s\,5p^3$	$5p^3\ ^3S^\circ$	1	*111671.1*	
$5s^2\,5p(^2P_{1/2})8s$	$8s\ ^3P^\circ$	0 1 2	*112356.9*	
$5s^2\,5p(^2P^\circ)6d$	$6d\ ^3P^\circ$	0 1 2	*112404.1*	
$5s^2\,5p(^2P^\circ)8s$	$8s\ ^1P^\circ$	1	*112733.0*	
$5s\,5p^3$	$5p^3\ ^1P^\circ$	1	*113904.5*	
$5s^2\,5p(^2P^\circ)7d$	$7d\ ^1P^\circ$	1	*128517.0*?	
Sb III $(^2P_{1/2})$	*Limit*	------	133327.5	

December 1953.

Sb III

(In I sequence; 49 electrons) $Z=51$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 5s^2\ 5p\ ^2P^\circ_{0\frac{1}{2}}$

$5p\ ^2P^\circ_{0\frac{1}{2}}$ 204248 K I. P. 25.3 volts

In 1930 Lang published a list of empirical term values of Sb III, based on an absolute value of $4f\ ^2F^\circ=64000$ K, arbitrarily chosen by comparison with the run of the terms in the In I and Sn II spectra. In 1932 he and Vestine investigated the Sb II spectrum and in the course of the work re-examined the Sb III lines. As a result they rejected 5 of the previously published Sb III terms.

In 1947 Murakawa and Suwa revised and extended the earlier analysis, from observations made with a condensed hollow-cathode discharge in a neon atmosphere, as the source. They retained two levels rejected by Lang and Vestine, namely, the ^4P levels 54365 K and 57960 K. Nine terms are common to the two lists; and the two levels 92948 K and 93417 K appear with different designation assignments. The limit and tabular data quoted here are from this later paper.

There are 49 classified lines between 691 A and 6926 A. The spectrum needs further study.

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J. S. Badami, Nature **136**, 836 (1935). (hfs)
K. Murakawa and S. Suwa, Reports Inst. Sci. Tech. Tokyo Univ. **1**, 121 (1947). (I P) (T) (C L)

Sb III

Config.	Desig.	J	Level	Interval
$5s^2(^1S)5p$	$5p\ ^2P^\circ$	0½ 1½	*0* *6576*	6576
$5s\ 5p^2$	$5p^2\ ^4P$	0½ 1½ 2½	54365 57960 64356	3595 6396
$5s\ 5p^2$	$5p^2\ ^2D$	1½ 2½	76522. 8 77791. 9	1269. 1
$5s\ 5p^2$	$5p^2\ ^2P$	0½ 1½	92948. 9 101953. 5	9004. 6
$5s^2(^1S)6s$	$6s\ ^2S$	0½	93417. 8	
$5s^2(^1S)5d$	$5d\ ^2D$	1½ 2½	98819. 5 100385. 4	1565. 9
$5s\ 5p^2$	$5p^2\ ^2S$	0½	100010?	

Sb III

Config.	Desig.	J	Level	Interval
$5s^2(^1S)6p$	$6p\ ^2P^\circ$	0½ 1½	*114720. 5* *116388. 5*	1668. 0
$5s^2(^1S)4f$	$4f\ ^2F^\circ$	3½ 2½	*136813. 6* *136869. 6*	−56. 0
$5s^2(^1S)7s$	$7s\ ^2S$	0½	143126. 8	
$5s^2(^1S)6d$	$6d\ ^2D$	1½ 2½	144682. 6 144918. 6	236. 0
$5s^2(^1S)8s$	$8s\ ^2S$	0½	163388. 2	
$5s^2(^1S)5g$	$5g\ ^2G$	3½, 4½	164302. 0	
$5s^2(^1S)6g$	$6g\ ^2G$	3½, 4½	176539. 7	
Sb IV ($^1S_0$)	*Limit*	--------	*204248*	

January 1954.

Sb IV

(Cd I sequence; 48 electrons) $Z=51$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,5s^2\;{}^1S_0$

$5s^2\;{}^1S_0$ 356156 K I. P. 44.1 volts

The analysis is seriously incomplete and needs revision from more precise wavelengths. The terms in the table are from Badami, who extended the ultraviolet work by Gibbs and Vieweg and by Green and Lang. He suggested that the configurations of the two low ${}^1D$ terms as given below be interchanged. This has not been done since $5p^2\;{}^1D$ is lower than $5s({}^2S)5d\;{}^1D$ in related spectra of the sequence. His complete array of combinations contains a total of 74 classified lines between 456 A and 3922 A.

Observed intersystem combinations connect the singlet and triplet systems of terms.

The limit is from Gibbs and Vieweg, who report some second series members and list absolute term values that fit an extrapolation along the isoelectronic sequence.

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J. E. Mack, Rev. Mod. Phys. **22**, No. 1, 64 (1950). (Summary hfs)

Sb IV

Config.	Desig.	J	Level	Interval
$5s^2$	$5s^2\;{}^1S$	0	0	
$5s({}^2S)5p$	$5p\;{}^3P^\circ$	0 1 2	*64435* *66700* *72560*	2265 5860
$5s({}^2S)5p$	$5p\;{}^1P^\circ$	1	*95952*	
$5p^2$	$5p^2\;{}^3P$	0 1 2	152076 156388 163524	4312 7136
$5p^2$	$5p^2\;{}^1D$	2	155956	
$5s({}^2S)5d$	$5d\;{}^3D$	1 2 3	178914 179264 179620	350 356
$5s({}^2S)5d$	$5d\;{}^1D$	2	182801	
$5s({}^2S)6s$	$6s\;{}^3S$	1	188622	
$5s({}^2S)6p$	$6p\;{}^3P^\circ$	0 1 2	*215386* *215736* *217802*	350 2066
$5s({}^2S)6p$	$6p\;{}^1P^\circ$	1	*219028*	
$5s({}^2S)4f$	$4f\;{}^3F^\circ$	2 3 4	*227059* *227144* *227304*	85 160
$5s({}^2S)4f$	$4f\;{}^1F^\circ$	3	*229592*	
$5s({}^2S)6d$	$6d\;{}^3D$	1 2 3	254683 254826 255079	143 253
$5s({}^2S)6d$	$6d\;{}^1D$	2	255558	
$5s({}^2S)7s$	$7s\;{}^3S$	1	257771	
$5s({}^2S)7s$	$7s\;{}^1S$	0	262912	
Sb V $({}^2S_{1/2})$	*Limit*	-------	356156	

August 1952.

Sb IV OBSERVED TERMS*

$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}+$	Observed Terms			
$5s^2$	$5s^2\ {}^1S$			
$5p^2$	$5p^2\ {}^3P$ $5p^2\ {}^1D$			
	$ns\ (n\geq 6)$	$np\ (n\geq 5)$	$nd\ (n\geq 5)$	$nf\ (n\geq 4)$
$5s(^2S)nx$	$6, 7s\ {}^3S$ $7s\ {}^1S$	$5, 6p\ {}^3P^{\circ}$ $5, 6p\ {}^1P^{\circ}$	$5, 6d\ {}^3D$ $5, 6d\ {}^1D$	$4f\ {}^3F^{\circ}$ $4f\ {}^1F^{\circ}$

*For predicted terms in the spectra of the Cd I isoelectronic sequence, see Vol. III, Introduction.

Sb V

(Ag I sequence; 47 electrons) $Z=51$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 5s\ {}^2S_{1/2}$

$5s\ {}^2S_{1/2}$ 449300 K I. P. 56 volts

This spectrum is very incompletely known. The analysis is from Badami, who has revised the early work of Lang on the basis of observations by Gibbs, Vieweg, and Gartlein, added $6p\ {}^2P^{\circ}$, and rejected Lang's $5f\ {}^2F^{\circ}$ term. There are 12 classified lines in the range 699.22 A to 3362.94 A.

The limit is from Lang, who derived absolute term values "by treating the f-orbits as hydrogenic — and obtaining thus an estimate of the F term value." His terms fit a Moseley diagram of the isoelectronic sequence Ag I to Sb V. This limit may be considerably in error. Further observations are needed to extend the series.

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J. S. Badami, Proc. Phys. Soc. (London) 43, 541 (1931). (T) (C L)

Sb V

Config.	Desig.	J	Level	Interval
$4d^{10}(^1S)5s$	$5s\ {}^2S$	$0\frac{1}{2}$	0	
$4d^{10}(^1S)5p$	$5p\ {}^2P^{\circ}$	$0\frac{1}{2}$ $1\frac{1}{2}$	*81566* *90553*	8987
$4d^{10}(^1S)5d$	$5d\ {}^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	201927 203043	1116
$4d^{10}(^1S)6s$	$6s\ {}^2S$	$0\frac{1}{2}$	224653	
$4d^{10}(^1S)6p$	$6p\ {}^2P^{\circ}$	$0\frac{1}{2}$ $1\frac{1}{2}$	*254380* *257579*	3199
Sb VI ($^1S_0$)	*Limit*	-------	449300	

March 1953.

Sb VI

(Pd I sequence; 46 electrons) $Z=51$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\;{}^1S_0$

$4d^{10}\;{}^1S_0$ 868140 K I. P. 108 volts

Schoepfle classified 31 lines in the interval 883.45 A to 1331.59 A, but did not observe the resonance lines. The lines were classified from a study of a Moseley diagram of the sequence. Later, Kruger and Shoupp reported three lines in the region between 279 A and 291A as combinations from the ground term, and revised Schoepfle's value of $5p\;{}^1P^\circ$. They give the limit quoted above and have also based their work on a study of a Moseley diagram. The quoted ionization potential may be in error by several volts. The tabular entries are from the earlier paper supplemented by these later additions and corrections. The writer has rounded off the values, and entered the J-value of the parent term by analogy with Pd I.

The singlet and triplet systems of terms are connected by observed intersystem combinations.

The level values of these terms published by L. and E. Bloch in 1937 derived from their own measurements differ considerably from those in the table, but there is agreement on the resonance lines at 284 A and 279 A representing combinations of the ground term with $5p\;{}^1P^\circ_1$ and $5p\;{}^3D^\circ_1$, respectively.

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L. Bloch et E. Bloch, J. Phys. Rad. [7] 8, 224 (1937). (T) (C L)

Sb VI

Config.	Desig.	J	Level	Interval
$4d^{10}$	$4d^{10}\;{}^1S$	0	0	
$4d^9({}^2D_{2\frac{1}{2}})5s$	$5s\;{}^3D$	3	243220	−2770
		2	245990	−7220
$4d^9({}^2D_{1\frac{1}{2}})5s$		1	253210	
$4d^9({}^2D_{1\frac{1}{2}})5s$	$5s\;{}^1D$	2	256360	
$4d^9({}^2D_{2\frac{1}{2}})5p$	$5p\;{}^3P^\circ$	2	*331460*	−11070
		1	*342530*	−6270
$4d^9({}^2D_{1\frac{1}{2}})5p$		0	*348800*	
$4d^9({}^2D_{2\frac{1}{2}})5p$	$5p\;{}^3F^\circ$	4	*343250*	8320
		3	*334930*	−3230
$4d^9({}^2D_{1\frac{1}{2}})5p$		2	*348160*	

Sb VI

Config.	Desig.	J	Level	Interval
$4d^9({}^2D_{2\frac{1}{2}})5p$	$5p\;{}^3D^\circ$	3	*349570*	6770
		2	*342800*	−14620
$4d^9({}^2D_{1\frac{1}{2}})5p$		1	*357420*	
$4d^9({}^2D_{1\frac{1}{2}})5p$	$5p\;{}^1P^\circ$	1	*351010*	
$4d^9({}^2D_{1\frac{1}{2}})5p$	$5p\;{}^1F^\circ$	3	*355300*	
$4d^9({}^2D_{1\frac{1}{2}})5p$	$5p\;{}^1D^\circ$	2	*359170*	
Sb VII$({}^2D_{2\frac{1}{2}})$	*Limit*	-------	[868140]	

March 1953.

Sb XXIII

(Cu I sequence; 29 electrons) $Z=51$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s\;{}^2S_{\frac{1}{2}}$

$4s\;{}^2S_{\frac{1}{2}}$ K I. P. volts

This spectrum has not been analyzed, but Edlén has observed the leading doublets from the $4s$–$5p$ and $4p$–$5d$ configurations from Pd XVIII to In XXI. In figure 3 of his paper on the spectra of highly-ionized atoms, the lines are indicated on the photograph of vacuum-spark spectra of these elements from 40 A to 80 A. He states that the doublets have been traced in this sequence as far as Sb XXIII.

By analogy with Cu I the writer has assumed the ground state indicated above.

REFERENCE

B. Edlén, Physica 13, No. 9, 548 (1947).

March 1953

TELLURIUM

Te I

52 electrons | | **$Z=52$**

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 5s^2\ 5p^4\ {}^3P_2$

$5p^4\ {}^3P_2$ 72667 K | | **I. P. 9.01 volts**

The analysis is from Ruedy, who has classified 62 lines between 5083.0A and 11084.5A from observations he made by using an electrodeless discharge tube as the source, thus revising and extending the early work by McLennan and others.

The writer has tentatively assigned J-values to the members of the $7p\ {}^3P$ term on the basis of the intensities of the combination with $6s\ {}^3S^\circ_1$. The ${}^5D^\circ$ terms are listed in the table as unresolved, although the author assigns $J=2$ to the observed levels of this series.

In 1929, McLennan and Crawford predicted the positions of the two terms $5p^4\ {}^1D_2$ and $5p^4\ {}^1S_0$ by extrapolation from the first spectra of the oxygen group. These "forbidden" transitions have since been confirmed by laboratory observations, and are described in detail in the 1938 reference below. They are attributed to magnetic dipole and electric quadrupole radiation. The predicted positions of these terms are quoted in the table.

Bartelt revised and extended Ruedy's analysis in 1934, on the basis of observations by McLennan and his associates, and listed 42 classified lines between 1645A and 3175.15A. Further confirmation of his results based on more precise observations is needed.

Ruedy has derived the limit from the $6p\ {}^5P_3-ns\ {}^5S^\circ_2$ series ($n=9$, 10, 11), by means of a Hicks formula.

The Zeeman effect in the spectra of tellurium is being investigated by Vander Sluis and Griffin at the Oak Ridge National Laboratory. Their extension of the Te I analysis is in progress but will not be completed in time for inclusion here. This spectrum is in serious need of further study, particularly in the short wave region.

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H. E. Walchli, *A Table of Nuclear Moment Data*, Oak Ridge Nat. Lab., ORNL–1469 Suppl. II, 29 (1955). (Summary hfs).
P. M. Griffin, letter (January 1957).

Te I

Config.	Desig.	J	Level	Interval	Obs. g
$5p^4$	$5p^4\ ^3P$	2 1 0	0 4751 4707	−4751 44	1.49
$5p^4$	$5p^4\ ^1D$	2	10559		
$5p^4$	$5p^4\ ^1S$	0	23199		
$5p^3(^4S^\circ)6s$	$6s\ ^5S^\circ$	2	*44253*		1.98
$5p^3(^4S^\circ)6s$	$6s\ ^3S^\circ$	1	*46653*		1.90
$5p^3(^4S^\circ)6p$	$6p\ ^5P$	1 2 3	54162 54201 54537	39 336	
$5p^3(^4S^\circ)6p$	$6p\ ^3P$	2 1 0	55813 55675 55846	138 −171	
$5p^3(^4S^\circ)7p$	$7p\ ^5P$	1 2 3	63557 63670 63921	113 251	
$5p^3(^4S^\circ)7p$	$7p\ ^3P$	2 1 0	63922 64089 63982	−167 107	
$5p^3(^4S^\circ)6d$	$6d\ ^3D^\circ$	1 to 3	*65695*		
$5p^3(^4S^\circ)8s$	$8s\ ^5S^\circ$	2	*65933*		
$5p^3(^4S^\circ)7d$	$7d\ ^5D^\circ$	0 to 4	*67437*		
$5p^3(^4S^\circ)7d$	$7d\ ^3D^\circ$	1 to 3	*68214*		
$5p^3(^4S^\circ)9s$	$9s\ ^5S^\circ$	2	*68364*		
$5p^3(^4S^\circ)8d$	$8d\ ^5D^\circ$	0 to 4	*69145*		
$5p^3(^4S^\circ)8d$	$8d\ ^3D^\circ$	1 to 3	*69577*		
$5p^3(^4S^\circ)10s$	$10s\ ^5S^\circ$	2	*69670*		
$5p^3(^4S^\circ)9d$	$9d\ ^5D^\circ$	0 to 4	*70137*		
$5p^3(^4S^\circ)9d$	$9d\ ^3D^\circ$	1 to 3	*70398*		
$5p^3(^4S^\circ)11s$	$11s\ ^5S^\circ$	2	*70462*		
$5p^3(^4S^\circ)10d$	$10d\ ^5D^\circ$	0 to 4	*70767*		
$5p^3(^4S^\circ)10d$	$10d\ ^3D^\circ$	1 to 3	*70930*		
$5p^3(^4S^\circ)11d$	$11d\ ^5D^\circ$	0 to 4	*71184*		
$5p^3(^4S^\circ)11d$	$11d\ ^3D^\circ$	1 to 3	*71297*		
$5p^3(^4S^\circ)12d$	$12d\ ^3D^\circ$	1 to 3	*71557*		
$5p^3(^4S^\circ)13d$	$13d\ ^3D^\circ$	1 to 3	*71749*		
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Te II ($^4S^\circ_{1\frac{1}{2}}$)	*Limit*	------	72667		

January 1957.

Te I Observed Terms*

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 5s^2+$	Observed Terms		
$5p^4$	{ $5p^4\ ^3P$ $5p^4\ ^1S$ $5p^4\ ^1D$		
	$ns\ (n \geq 6)$	$np\ (n \geq 6)$	$nd\ (n \geq 5)$
$5p^3(^4S^\circ)nx$	{ 6, 8 to 11s $^5S^\circ$ 6s $^3S^\circ$	6, 7p ^5P 6, 7p ^3P	7 to 11d $^5D^\circ$ 6 to 13d $^3D^\circ$

*For predicted terms in the spectra of the Te I isoelectronic sequence, see Vol. III, Introduction.

Te II

(Sb I sequence; 51 electrons) $Z=52$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 5s^2\ 5p^3\ {}^4S^{\circ}_{1\frac{1}{2}}$

$5p^3\ {}^4S^{\circ}_{1\frac{1}{2}}$ ***150000±3000*** K I. P. 18.6±0.4 volts

The analysis is by Handrup and Mack, who have revised and extended the earlier work on this spectrum especially for inclusion here. Their investigation is still in progress. It has been carried to its present state only with the aid of the excellent Zeeman effect data furnished by Vander Sluis and Griffin of the Oak Ridge National Laboratory, and of ultraviolet line measurements from plates made by S. Avellén of Lund University. The g-values quoted here supplement and partly supersede those published in the 1951 reference.

There are 29 odd and 38 even levels listed in the table, of which 4, listed with question marks, need further confirmation. All odd levels are in italics. The observations extend from 157 A to 8972 A, and about 300 lines have been classified.

The zeros after the decimal point in the level 71193.00 have been arbitrarily adopted by the authors because of the inaccuracy of the far ultraviolet wave numbers on which the combinations from the ground term are based.

The configurations $5s\ 5p^4$ and $5s^2\ 5p^2({}^3P\ {}^1D\ {}^1S)6p$ are almost completely known. The authors point out, however, that on account of the effects of configuration-interaction and intermediate coupling, in many cases the assignment of configurations and LS-designations has little meaning. For example, at least the two levels 76301 and 78448 contribute to $5p^4\ {}^4P_{0\frac{1}{2}}$. The limit terms ${}^3P$, ${}^1D$, ${}^1S$ are, also, not indicated in the table for most levels of the $5s^2\ 5p^2\ nx$ configurations; and a number of configurations are listed for groups of levels. Ross and Murakawa have suggested some approximate quantum number assignments.

No series have been found in Te II, but from the spacing of successive groups of levels Handrup and Mack estimate the series limit quoted above. Their ionization potential agrees well with the value 18.8±0.5 volts interpolated by Finkelnburg and Humbach from a study of screening constants.

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Te II

Config.	Desig.	J	Level	Interval	Obs. g
$5s^2 5p^3$	$5p^3\ {}^4S^\circ$	1½	*0*		
$5s^2 5p^3$	$5p^3\ {}^2D^\circ$	1½ 2½	*10222* *12423*	2201	
$5s^2 5p^3$	$5p^3\ {}^2P^\circ$	0½ 1½	*20546* *24033*	3487	
$5s\ 5p^4$	$5p^4\ {}^4P$	2½	71193.00	−3700.85	1.59
$5s\ 5p^4$	$5p^4\ {}^4P$	1½	74893.85		1.71
		0½	76301.30		2.63
		0½	78448.63		2.29
		1½	81895.89		1.12
		1½	82743.83		1.45
		0½	83577.90		1.06
		2½	85049.79		1.09
$5s\ 5p^4$		1½	85160.15		0.88
$5s^2 5p^2 6s$		2½	85592.36		1.50
$5s^2 5p^2 5d$		1½	86760.28		0.94
		2½	87404.98		1.25
		2½	88925.17		1.06?
		1½	88961.52		1.17
		1½	92192.22		1.13
		2½	92793.80		1.24
$5s^2 5p^2(^3P)6p$		0½	*93979.34*		0.79
$5s\ 5p^4$ $5s^2 5p^2 6s$ $5s^2 5p^2 5d$		2½	94860.95		1.28
		1½	95208.88		0.98
		1½	*96145.17*		1.32
		0½	*97780.47*		1.26
		1½	*99585.02*		1.26
		2½	*100112.52*		1.40
		1½	*101221.44*		1.31
		0½	*101371.26*		2.32
$5s^2 5p^2(^3P)6p$		2½	*102324.95*		1.31
		3½	*103106.32*		1.38
		1½	*103936.38*		1.74
		1½	*105006.55*		1.21
		2½	*105583.48*		1.29
		0½	*106119.73*		0.88

Te II

Config.	Desig.	J	Level	Interval	Obs. g
		2½	*111947.17*		1.19
		1½	*112272.87*		1.09
$5s^2 5p^2(^1D)6p$		2½	*112549.29*		1.06
		3½	*112788.89*		1.19
$5s^2 5p^2 7s$ $5s^2 5p^2 6d$		0½	112824.36		2.16
$5s^2 5p^2(^1D)6p$		0½	*114069.12*		0.77
$5s^2 5p^2 7s$ $5s^2 5p^2 6d$		1½	115700.94		0.91
$5s^2 5p^2(^1D)6p$		1½	*116102.19*		1.29
		2½	116837.76?		1.20
$5s^2 5p^2 7s$		0½?	117192.78		
$5s^2 5p^2 6d$		1½	117264.36		0.98
		1½	117340.09		1.60
		2½	*117686.31*		0.85
		3½	*117859.52*		1.13
		0½?	118009.36		
		0½	118325.30		1.17
		2½	120617.57		1.51
$5s^2 5p^2 7s$		2½	121064.23		
$5s^2 5p^2 6d$		0½	121106.68		0.52
		1½	121174.38		1.23
		1½	121519.36		1.20
		2½	122197.27		1.07
$5s^2 5p^2 7p$		2½	*122616.98?*		1.06
$5s^2 5p^2 4f$		2½	*122888.03*		
		3½	123655.00		1.24
$5s^2 5p^2 7s$		0½	124082.49		
$5s^2 5p^2 6d$		2½	124646.81		1.32
		3½	125967.61		1.15
$5s^2 5p^2 7p$ $5s^2 5p^2 4f$		3½	*126164.69?*		
$5s^2 5p^2 7s$		0½	126212.47		2.03
$5s^2 5p^2 6d$		1½	126517.39		0.98
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Te III ($^3P_0$)	*Limit*	------	*150000*		

January 1957.

Te III

(Sn I sequence; 50 electrons) $Z=52$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 5s^2\ 5p^2\ {}^3P_0$

$5p^2\ {}^3P_0$ 247000 K I. P. 31 volts

This spectrum is in serious need of further study. Krishnamurty and Rao have classified approximately 200 lines between 612 A and 6977 A. R. J. Lang furnished them with an unpublished list of lines in the region between 600 A and 2000 A, to supplement their observations.

The limit is derived from the two-member series $np\ {}^3P$, namely, $6s\ {}^3P^\circ_2 - 5p^2\ {}^3P_2$ and $6s\ {}^3P^\circ_2 - 6p\ {}^3P_2$, and "a very large error is possible when the limit is obtained solely from the above series in which the first member lies in the extreme ultra-violet." A rounded-off value is quoted in the table.

Observed intersystem combinations connect the singlet and triplet systems of terms.

The observed g-values in the table are from the paper by Green and Loring.

The writer has revised several of the published term designations to conform more nearly to the related spectra Sn I and Sb II, and to give better agreement with the observed g-values. Some J-values of the limit term have been added in column one of the table, and more levels are entered as miscellaneous than in the published papers. The more dubious levels have been omitted here pending confirmation. The tabular data are tentative, but should serve as a guide in the search for more regularities.

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J. B. Green and R. A. Loring, Phys. Rev. 90, 82 (1953). (Z E)

Te III

Config.	Desig.	J	Level	Interval	Obs. g
$5s^2\ 5p^2$	$5p^2\ {}^3P$	0	0		
		1	4751	4751	
		2	8165	3414	
$5s^2\ 5p^2$	$5p^2\ {}^1D$	2	17358		
$5s\ 5p^3$		1	*82885.7*		
		1	*92300.9*		
$5s\ 5p^3$		2	*93706.3*		
″	${}^3P^\circ$	2	*95024.6*		
″	${}^3P^\circ$	1	*96574.4*		
″	${}^1D^\circ$	2	*100463.4*		1.13
		1	*101149.0*		
$5s^2\ 5p(^2P^\circ)5d$	${}^3F^\circ$	2	*104708.8*		
″	${}^3F^\circ$	3	*106305.6*		1.07
$5s^2\ 5p(^2P^\circ_{1/2})6s$	$6s\ {}^3P^\circ$	0	*107462.1*		
″		1	*107717.7*	255.6	1.37
$5s^2\ 5p(^2P^\circ_{1\frac{1}{2}})6s$		2	*115416.0*	7698.3	1.28
		2	*109006.1*		
$5s^2 5p(^2P^\circ_{1\frac{1}{2}})6s$	$6s\ {}^1P^\circ$	1	*114209.9*		1.00
$5s^2\ 5p(^2P^\circ)5d$	$5d\ {}^3P^\circ$	0			
		1	*117789.4*		1.26
$5s^2\ 5p(^2P^\circ_{1\frac{1}{2}})5d$		2	*116711.9*	−1077.5	1.34
$5s^2\ 5p(^2P^\circ)5d$	$5d\ {}^3D^\circ$	1	*115739.4*		
		2	*122510.1*	6770.7	
		3	*120896.7*	−1613.4	1.35
		1 or 2	*122121.2*		

Te III—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})5d$	$5d\ ^1D^\circ$	2	*124783.3*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})5d$	$5d\ ^1P^\circ$	1	*127183.6*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})5d$	$5d\ ^1F^\circ$	3	*127241.8*		
$5s^2\,5p(^2P^\circ_{\frac{1}{2}})6p$	$6p\ ^3D$	1	128617.9	3711.2	0.68
"		2	132329.1	7620.6	1.16
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})6p$		3	139949.7		1.28
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})6p$	$6p\ ^1P$	1	138289.7		1.02
$5s^2\,5p(^2P^\circ_{\frac{1}{2}})6p$	$6p\ ^3P$	0	132262.4	−145.7	
"		1	132116.7	7547.8	1.24
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})6p$		2	139664.5		1.43
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})6p$	$6p\ ^3S$	1	141803.0		1.76
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})6p$	$6p\ ^1D$	2	142982.0		1.14
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})6d$	$6d\ ^3P^\circ$	0			
"		1	*161192.6*	8819.6	1.43
"		2	*170012.2*		
$5s^2\,5p(^2P^\circ_{\frac{1}{2}})6d$	$6d\ ^3F^\circ$	2	*162737.8*	988.6	
"		3	*163726.4*	4817.3?	
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})6d$		4	*168543.7?*		
$5s^2\,5p(^2P^\circ_{\frac{1}{2}})6d$	$6d\ ^3D^\circ$	1	*163324.9*	3286.5	
"		2	*166611.4*	4450.5	
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})6d$		3	*171061.9*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})6d$	$6d\ ^1F^\circ$	3	*168071.9*		
$5s^2\,5p(^2P^\circ_{\frac{1}{2}})7s$	$7s\ ^3P^\circ$	0			
"		1	*170583.4*	7827.5	
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})7s$		2	*178410.9*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})6d$	$6d\ ^1D^\circ$	2	*171962.4*		
		1 or 2	*172888.8*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})6d$	$6d\ ^1P^\circ$	1	*173569.8*		
$5s^2\,5p(^2P^\circ_{1\frac{1}{2}})7s$	$7s\ ^1P^\circ$	1	*174497.5*		
Te IV $(^2P^\circ_{\frac{1}{2}})$	*Limit*	-------	247000		

October 1953.

Te IV

(In I sequence; 49 electrons) $Z=52$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,5s^2\,5p\ ^2P^\circ_{0\frac{1}{2}}$

$5p\ ^2P^\circ_{0\frac{1}{2}}$ ***305091*** K I. P. 38 volts

The analysis is from Rao, who has classified 27 lines between 749 A and 3585 A. An error in the published value of $7s\ ^2S$ is corrected here. His value of the limit is the mean derived from a Rydberg formula for the ^2S and ^2D series of two members each. From isoelectronic sequence data he estimates that the error in the absolute term values "probably does not exceed about 3000 cm^{-1}". Further study of the spectrum is needed.

The g-values are from the observed Zeeman pattern of the line 3585.27 A—the only Te IV line observed by Green and Loring.

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J. B. Green and R. A. Loring, Phys. Rev. **90**, 80 (1953). (Z E)

Te IV

Config.	Desig.	J	Level	Interval	Obs. g
$5s^2(^1S)5p$	$5p\ ^2P^\circ$	$0\frac{1}{2}$ $1\frac{1}{2}$	*0* *9223*	9223	
$5s\,5p^2$	$5p^2\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	92772 94811	2039	
$5s\,5p^2$	$5p^2\ ^2S$	$0\frac{1}{2}$	109536		
$5s\,5p^2$	$5p^2\ ^2P$	$0\frac{1}{2}$ $1\frac{1}{2}$	119009 119956	947	
$5s^2(^1S)5d$	$5d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	127445.0 128216.5	771.5	
$5s^2(^1S)6s$	$6s\ ^2S$	$0\frac{1}{2}$	133456.0		2.02
$5s^2(^1S)6p$	$6p\ ^2P^\circ$	$0\frac{1}{2}$ $1\frac{1}{2}$	*161339.4* *163959.0*	2619.6	0.66
$5s^2(^1S)7s$	$7s\ ^2S$	$0\frac{1}{2}$	205343.6		
$5s^2(^1S)6d$	$6d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	202941.4 203352.8	411.4	
Te V ($^1S_0$)	*Limit*	----------	*305091*		

August 1953.

Te V

(Cd I sequence; 48 electrons) $Z=52$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,5s^2\ ^1S_0$

$5s^2\ ^1S_0$ **486244 K** I. P. 60 volts

The spectrum is incompletely known, but Gibbs and Vieweg have classified 23 lines between 603 A and 1549 A. Their absolute term values have been extrapolated on a Moseley diagram of the isoelectronic sequence. Observed intersystem combinations connect the singlet and triplet systems of terms.

L. and E. Bloch have observed five additional lines between 358 A and 402 A, from which they derive the three following levels:

$6p\ ^3P^\circ_1$	*274454*
$6p\ ^1P^\circ_1$	*278738*
$7s\ ^3S_1$	334459

These levels require further confirmation.

From a study of screening constants Finkelnburg and Humbach have interpolated an ionization potential of 66 volts.

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L. et E. Bloch, J. Phys. Rad. [7] **6**, 441 (1935). (T) (C L)
W. Finkelnburg und W. Humbach, Naturwiss. **42**, 35 (1955). (I P)

Te v

Config.	Desig.	J	Level	Interval
$5s^2$	$5s^2\ ^1S$	0	0	
$5s(^2S)5p$	$5p\ ^3P^\circ$	0 1 2	*75109* *78023* *85997*	2914 7974
$5s(^2S)5p$	$5p\ ^1P^\circ$	1	*111707*	
$5p^2$	$5p^2\ ^3P$	0 1 2	176248 182419 192592	6171 10173
$5p^2$	$5p^2\ ^1D$	2	182797	
$5s(^2S)5d$	$5d\ ^3D$	1 2 3	215612 216137 216989	525 852
$5s(^2S)5d$	$5d\ ^1D$	2	221493	
$5s(^2S)6s$	$6s\ ^3S$	1	240637	
Te vi ($^2S_{1/2}$)	*Limit*	----------	486244	

August 1955.

Te vi

(Ag i sequence; 47 electrons) $Z=52$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 5s\ ^2S_{1/2}$

$5s\ ^2S_{1/2}$ 583500 K I. P. 72 volts

This spectrum is incompletely analyzed. The terms are from K. R. Rao, who has classified 10 lines in the range between 540.24 A and 1313.90 A. The limit is a mean value of that given by the $ns\ ^2S$ series ($n=5$, 6) derived by a Rydberg formula, and of the one given by an extrapolation along the isoelectronic sequence based on Moseley's law. The writer has rounded off the value of this mean. Further observations are needed to lengthen the series and correct the present inaccuracy in the limit.

REFERENCE

K. R. Rao, Proc. Royal Soc. London [A] 133, 220 (1931). (I P) (T) (C L)

Te vi

Config.	Desig.	J	Level	Interval
$4d^{10}(^1S)5s$	$5s\ ^2S$	$0\frac{1}{2}$	0	
$4d^{10}(^1S)5p$	$5p\ ^2P^\circ$	$0\frac{1}{2}$ $1\frac{1}{2}$	*93336* *105150*	11814
$4d^{10}(^1S)5d$	$5d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	238081 239725	1644
$4d^{10}(^1S)6s$	$6s\ ^2S$	$0\frac{1}{2}$	278439	
$4d^{10}(^1S)6p$	$6p\ ^2P^\circ$	$0\frac{1}{2}$ $1\frac{1}{2}$	*314190* *318589*	4399
Te vii ($^1S_0$)	*Limit*	-------	583500	

March 1953.

Te VII

(Pd I sequence; 46 electrons) $Z=52$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\ ^1S_0$

$4d^{10}\ ^1S_0$ 1106360 K I. P. 137 volts

In 1933 Schoepfle classified 24 lines between 784.09 A and 1123.36 A, but did not observe the resonance lines. The following year Kruger and Shoupp reported three lines in the region from 227 A to 236 A as combinations from the ground term, and revised the earlier value of $5p\ ^1P^\circ_1$. Their limit, quoted above, and all the terms are based on a study of a Moseley diagram for the isoelectronic sequence. The quoted ionization potential may be in error by several volts. The terms in the table are from the 1933 paper supplemented by these later additions and corrections. The writer has rounded off the values, and assigned the J-value of the parent term by analogy with Pd I.

The singlet and triplet systems of terms are connected by observed intersystem combinations.

The level values of these same terms published by L. and E. Bloch in 1937 as prepared from their own measurements differ considerably from those adopted here, but there is agreement on the two resonance lines at 232 A and 227 A representing combinations from the ground term to $5p\ ^1P^\circ$ and $5p\ ^3D^\circ_1$, respectively.

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P. G. Kruger and W. E. Shoupp, Phys. Rev. 46, 124 (1934). (I P) (T) (C L)
L. Bloch et E. Bloch, J. Phys. Rad. [7] 8, 224 (1937). (T) (C L)

Te VII

Config.	Desig.	J	Level	Interval
$4d^{10}$	$4d^{10}\ ^1S$	0	0	
$4d^9(^2D_{2\frac{1}{2}})5s$	$5s\ ^3D$	3	309000	−3090
$4d^9(^2D_{2\frac{1}{2}})5s$		2	312090	−8280
$4d^9(^2D_{1\frac{1}{2}})5s$		1	320370	
$4d^9(^2D_{1\frac{1}{2}})5s$	$5s\ ^1D$	2	323620	
$4d^9(^2D_{2\frac{1}{2}})5p$	$5p\ ^3P^\circ$	2	*409310*	−13560
$4d^9(^2D_{2\frac{1}{2}})5p$		1	*422870*	−7180
$4d^9(^2D_{1\frac{1}{2}})5p$		0	*430050*	
$4d^9(^2D_{2\frac{1}{2}})5p$	$5p\ ^3F^\circ$	4	*428940*	10300
$4d^9(^2D_{2\frac{1}{2}})5p$		3	*418640*	−15510
$4d^9(^2D_{1\frac{1}{2}})5p$		2	*434150*	
$4d^9(^2D_{2\frac{1}{2}})5p$	$5p\ ^3D^\circ$	3	*429910*	8300
$4d^9(^2D_{2\frac{1}{2}})5p$		2	*421610*	−17350
$4d^9(^2D_{1\frac{1}{2}})5p$		1	*438960*	
$4d^9(^2D_{1\frac{1}{2}})5p$	$5p\ ^1P^\circ$	1	*430410*	
$4d^9(^2D_{1\frac{1}{2}})5p$	$5p\ ^1F^\circ$	3	*436580*	
$4d^9(^2D_{1\frac{1}{2}})5p$	$5p\ ^1D^\circ$	2	*440870*	
Te VIII $(^2D_{2\frac{1}{2}})$	*Limit*	-------	1106360	

March 1953.

IODINE

I II

53 electrons $Z=53$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 5s^2\ 5p^4\ {}^3P_2$

$5p^3\ {}^4S^{\circ}_{1\frac{1}{2}}$ *84340* K I. P. 10.454 volts

The analysis is by Kiess and Corliss, who have reobserved the spectrum, revised, and extended the earlier work especially for inclusion here. The new observations extend from 1200 A to 23000 A. The Vacuum Spectrograph of the Bureau was used for the short-wave region. For wavelengths longer than 12000 A observations were made by Plyler and by Humphreys, who used PbS detectors with an electrodeless discharge as source.

From 2000 A to 13000 A the lines were measured relative to the International Secondary Standards of Iron. Precise energy-level values were derived by means of the 400 lines classified in this range. The values were then used to calculate wavelengths suitable as standards in the regions shorter than 2000 A and longer than 12000 A, i. e., to correct the wavelength scales at the extreme ends of the observed range. The final line list thus has internally consistent standards over the entire range. The total number of classified lines is approximately 625. Observed intersystem combinations connect the systems of terms having different multiplicities.

The observed g-values are from Zeeman spectrograms taken in a magnetic field of about 36000 oersteds, with the Weiss magnet of the National Bureau of Standards.

The limit is excellently determined by means of a Ritz formula, from three series: $ns\ {}^5S^{\circ}_2(n=6\text{ to }11)$, $np\ {}^5P_3(n=6\text{ to }9)$, and $nd\ {}^5D^{\circ}_4(n=5\text{ to }9)$.

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I I

Config.	Desig.	J	Level	Interval	Obs. g
$5s^2\,5p^5$	$5p^5\ ^2P^\circ$	1½ 0½	*0.00* *7603.15*	−7603.15	0.673
$5s^2\,5p^4(^3P)6s$	$6s\ ^4P$	2½ 1½ 0½	54633.46 61819.81 60896.27	−7186.35 923.54	1.576 1.618 2.561
$5s^2\,5p^4(^3P)6s$	$6s\ ^2P$	1½ 0½	56092.88 63186.76	−7093.88	1.385 0.799
$5s^2\,5p^4(^3P)6p$	$6p\ ^4P^\circ$	2½ 1½ 0½	*64906.34* *67062.12* *65856.96*	−2155.78 1205.16	1.524 1.415 1.556
$5s^2\,5p^4(^3P)6p$	$6p\ ^4S^\circ$	1½	*64990.01*		1.619
$5s^2\,5p^4(^3P)6p$	$6p\ ^2D^\circ$	2½ 1½	*65644.49* *72807.21*	−7162.72	1.217 1.316
$5s^2\,5p^4(^3P)6p$	$6p\ ^4D^\circ$	3½ 2½ 1½ 0½	*65670.00* *72529.17* *71976.74* *73387.18*	−6859.17 552.43 −1410.44	1.420 1.370 1.317 1.137
$5s^2\,5p^4(^1D)6s$	$6s'\ ^2D$	2½ 1½	66020.64 66355.21	−334.57	1.258 0.828
$5s^2\,5p^4(\ \ )nd$	nd 1	1½	67298.45		
	nd 2	2½	68549.77		
	nd 3	2½	68588.00		
	nd 4	1½	68612.02		
	nd 5	2½	70151.32		
$5s^2\,5p^4(^1S)6s$	$6s''\ ^2S$	0½	70354.93		1.96
$5s^2\,5p^4(^3P)6p$	$6p\ ^2P^\circ$	0½ 1½	*71501.52* *73054.56*	1553.04	1.239 1.329
$5s^2\,5p^4(^3P)6p$	$6p\ ^2S^\circ$	0½	*71813.97*		1.377
$5s^2\,5p^4(^3P)7s$	$7s\ ^4P$	2½ 1½ 0½	71903.44 78891.16 78415.66	−6987.72 475.50	1.59
$5s^2\,5p^4(^3P)7s$	$7s\ ^2P$	1½ 0½	72294.83 79285.26	−6990.43	
$5s^2\,5p^4(\ \ )np$	np 1°	1½	*72875.75*		
$5s^2\,5p^4(\ \ )nd$	nd 6	1½	73114.72		
	nd 7	1½	73477.25		
	nd 8	1½	73639.28		
	nd 9	2½	73846.96		
	nd 10	3½	73977.68		1.21
	nd 11	1½	74587.40		0.78
	nd 12	1½	74625.56		
	nd 13	2½	74823.48		
$5s^2\,5p^4(^3P)7p$	$7p\ ^4P^\circ$	2½ 1½ 0½	*74965.77* *75621.41* *75303.13*	−655.64 318.28	1.472 1.483 1.53
$5s^2\,5p^4(^3P)7p$	$7p\ ^4S^\circ$	1½	*75049.57*		1.506
$5s^2\,5p^4(\ \ )nd$	nd 14	2½	75177.26		1.26
$5s^2\,5p^4(^3P)7p$	$7p\ ^2D^\circ$	2½ 1½	*75191.37* *82424.18*	−7232.81	1.24 1.27
$5s^2\,5p^4(^3P)7p$	$7p\ ^4D^\circ$	3½ 2½ 1½ 0½	*75194.10* *82033.80* *81722.98*	−6839.70 310.82	1.42 1.39
$5s^2\,5p^4(^3P)5d$	$5d\ ^4D$	3½	75511.13		1.320
$5s^2\,5p^4(^3P)5d$	$5d\ ^4F$	4½	75704.09		1.338
$5s^2\,5p^4(\ \ )nd$	nd 15	0½	75714.44		0.80
	nd 16	1½	75823.98		1.41
	nd 17	2½	75898.91		1.14
	nd 18	2½	76106.57		
	nd 19	1½	76136.43		1.04
$5s^2\,5p^4(\ \ )nd$	nd 20	0½	76746.98		
	nd 21	2½	76903.28		
$5s^2\,5p^4(^3P)4f$	$4f$ 1°	2½	*77307.47*		
	$4f$ 2°	3½	*77313.00*		
	$4f$ 3°	3½	*77330.66*		
	$4f$ 4°	1½	*77356.76*		
	$4f$ 5°	2½	*77359.62*		
	$4f$ 6°	1½	*77406.86*		
$5s^2\,5p^4(^3P)8s$	$8s\ ^4P$	2½	77450.76		1.563
$5s^2\,5p^4(^3P)8s$	$8s\ ^2P$	1½	77555.77		1.35
$5s^2\,5p^4(^1D)6p$	$6p'\ ^2P^\circ$	1½	*78415.36*		1.39
$5s^2\,5p^4(\ \ )np$	np 2°	1½	*78592.75*		1.00
$5s^2\,5p^4(^3P)8p$	$8p\ ^4P^\circ$	2½ 1½ 0½	*78732.31* *79224.78* *79203.11*	−492.47 21.67	1.454 1.30
$5s^2\,5p^4(^3P)7p$	$7p\ ^2P^\circ$	0½ 1½	*78780.04* *82431.20*	3651.16	1.479
$5s^2\,5p^4(^3P)8p$	$8p\ ^4S^\circ$	1½	*78815.61*		1.71
$5s^2\,5p^4(^3P)8p$	$8p\ ^2D^\circ$	2½	*78854.86*		1.11
$5s^2\,5p^4(^3P)6d$	$6d\ ^4D$	3½	78904.05		1.36
$5s^2\,5p^4(^3P)6d$	$6d\ ^4P$	2½	78943.37		1.41
$5s^2\,5p^4(^3P)8p$	$8p\ ^4D^\circ$	3½	*79003.70*		1.03
$5s^2\,5p^4(\ \ )nd$	nd 22	1½	79030.99		1.23
$5s^2\,5p^4(^3P)6d$	$6d\ ^4F$	4½	79055.01		1.332
$5s^2\,5p^4(\ \ )nd$	nd 23	3½	79150.55		
	nd 24	1½	79395.92		1.42
	nd 25	2½	79418.49		1.17
$5s^2\,5p^4(^3P)8p$	$8p\ ^2P^\circ$	0½	*79701.73*		1.02
$5s^2\,5p^4(^3P)5f$	$5f$ 1°	1½	*79835.03*		
	$5f$ 2°	0½	*79840.23*		
	$5f$ 3°	2½	*79844.58*		
	$5f$ 4°	3½	*79847.88*		
	$5f$ 5°	1½	*79881.74*		

I I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$5s^2 5p^4(^3P)9s$	$9s$ ^4P	$2\frac{1}{2}$	79914.68		1.56
$5s^2 5p^4(^3P)9s$	$9s$ ^2P	$1\frac{1}{2}$	79947.20		
$5s^2 5p^4(\ )np$	np 3°	$1\frac{1}{2}$	*80039.94*		1.50
	np 4°	$2\frac{1}{2}$	*80185.57*		1.05
$5s^2 5p^4(^3P)9p$	$9p$ $^4P^\circ$	$2\frac{1}{2}$	*80624.45*		
$5s^2 5p^4(^3P)7d$	$7d$ ^4D	$3\frac{1}{2}$	80676.17		1.40
$5s^2 5p^4(^3P)7d$	$7d$ ^4P	$2\frac{1}{2}$	80680.12		1.37
$5s^2 5p^4(\ )nd$	nd 26	$1\frac{1}{2}$	80690.98		
$5s^2 5p^4(^3P)9p$	$9p$ $^4S^\circ$	$1\frac{1}{2}$	*80720.85*		
$5s^2 5p^3(^3P)7d$	$7d$ ^4F	$4\frac{1}{2}$	80772.35		
$5s^2 5p^4(\ )nd$	nd 27	$1\frac{1}{2}$	80782.49		1.46
$5s^2 5p^4(^3P)9p$	$9p$ $^2D^\circ$	$2\frac{1}{2}$	*80797.95*		
$5s^2 5p^4(\ )nd$	nd 28	$3\frac{1}{2}$	80869.05		
$5s^2 5p^4(^3P)9p$	$9p$ $^4D^\circ$	$3\frac{1}{2}$	*80945.44*		1.32
$5s^2 5p^4(^3P)6f$	$6f$ 1°	$2\frac{1}{2}$	*81905.39*		
	$6f$ 2°	$3\frac{1}{2}$	*81907.32*		
	$6f$ 3°	$1\frac{1}{2}$	*81916.75*		
	$6f$ 4°	$2\frac{1}{2}$	*81919.30*		
$5s^2 5p^4(^3P)10s$	$10s$ ^4P	$2\frac{1}{2}$	81252.48		1.53
$5s^2 5p^4(\ )nd$	nd 29	$2\frac{1}{2}$	81371.2		
	nd 30	$0\frac{1}{2}$	81551.9		
	nd 31	$1\frac{1}{2}$	81642.25		
$5s^2 5p^4(^3P)7p$	$7p$ $^2S^\circ$	$0\frac{1}{2}$	*81506.82*		
$5s^2 5p^4(^3P)8d$	$8d$ ^4D	$3\frac{1}{2}$	81689.02		
$5s^2 5p^4(\ )np$	np 5°	$3\frac{1}{2}$	*81693.55*		
$5s^2 5p^4(^3P)8d$	$8d$ ^4F	$4\frac{1}{2}$	81760.58		
$5s^2 5p^4(^3P)7f$	$7f$ 1°	$2\frac{1}{2}$	*82026.90*		
	$7f$ 2°	$3\frac{1}{2}$	*82030.36*		
$5s\ 5p^6$	$5p^6$ ^2S	$0\frac{1}{2}$	82028.61		
$5s^2 5p^4(^3P)10p$	$10p$ $^4D^\circ$	$3\frac{1}{2}$	*82035.00*		
$5s^2 5p^4(^3P)11s$	$11s$ ^4P	$2\frac{1}{2}$	82074.10		
$5s^2 5p^4(\ )np$	np 6°	$2\frac{1}{2}$	*82214.04*		
$5s^2 5p^4(^3P)9d$	$9d$ ^4F	$4\frac{1}{2}$	82385.44		
$5s^2 5p^4(\ )nd$	nd 32	$2\frac{1}{2}$	82452.83		
$5s^2 5p^4(\ )np$	np 7°	$1\frac{1}{2}$	*82615.84*		
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I II($^3P_2$)	*Limit*	-----	*84340*		

October 1957.

I I Observed Terms*

Configuration $1s^2 2s^2 2p^6 3s^2 3p^6$ $3d^{10} 4s^2 4p^6 4d^{10}+$	Observed Terms		
$5s^2 5p^5$	$5p^5$ $^2P^\circ$		
$5s\ 5p^6$	$5p^6$ ^2S		
	ns ($n \geq 6$)	np ($n \geq 6$)	nd ($n \geq 5$)
$5s^2 5p^4(^3P)nx$	6 to 11s ^4P 6 to 9s ^2P	6 to 9p $^4S^\circ$ 6 to 9p $^4P^\circ$ 6 to 10p $^4D^\circ$ 6, 7p $^2S^\circ$ 6 to 8p $^2P^\circ$ 6 to 9p $^2D^\circ$	6, 7d ^4P 5 to 8d ^4D 5 to 9d ^4F
$5s^2 5p^4(^1D)nx'$	$6s'$ ^2D	$6p'$ $^2P^\circ$	
$5s^2 5p^4(^1S)nx''$	$6s''$ ^2S		

*For predicted terms in the spectra of the I I isoelectronic sequence, see Vol. III, Introduction.

I II

(Te I sequence; 52 electrons) $Z=53$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,5s^2\,5p^4\;{}^3P_2$

$5p^4\;{}^3P_2$ 154050 K I. P. 19.09 volts

The analysis is chiefly by Lacroute who reported in 1935 that more than 1200 lines were known. He published Zeeman data for many lines and observed several series. He utilized the measurements of L. Bloch and E. Bloch in the region from about 2200 A to 798 A.

Murakawa in studying the hyperfine structure of I II also reported regularities in the spectrum, and in 1938 revised the series and extended the analysis. Lacroute carried the work further and published in 1939 the term list that has been used for the analysis reported here. Ten levels have been omitted as extremely dubious.

A new description of I II is in course of preparation by Kiess, Corliss, and Martin at the National Bureau of Standards. The available observations extend from 2023.100 A to 9046.27 A and include Zeeman spectrograms taken with metal halide lamps as the source. The writer has revised the known term values from these new measurements by starting with $6p\;{}^5P_3$ equal to 100410.00K. These values are given to two decimal places in the table. A complete new description of I II in the region short of 2000 A is in progress at the Bureau. Several excellent spectrograms extending from 800 A to 2500 A have just been obtained. With these observations, additions and corrections to the tabular data will be made.

There are approximately 500 classified lines. Observed intersystem combinations connect the systems of terms of different multiplicities.

Martin has added some new levels, extended the known series, and derived the limit quoted above, from the $ns\;{}^{3,5}S^\circ$ series ($n=6$ to 9), by means of an extended Ritz formula.

Most of the observed g-values in the table given to two decimal places are from Lacroute. All three-place entries are new values derived from the Bureau Zeeman data.

REFERENCES

P. Lacroute, Ann. de Phys. (11) **3**, 5 (1935). (I P) (T) (C L) (Z E)

K. Murakawa, Zeit. Phys. **109**, 162 (1938). (I P) (T) (C L) (hfs)

P. Lacroute, Ann. d'Astroph. **2**, 318 (1939). (I P) (T) (C L) (Z E)

C. C. Kiess, C. H. Corliss, and W. C. Martin, unpublished material (December 1957). (I P) (T) (C L) (Z E)

I II

Config.	Desig.	J	Level	Interval	Obs. g
$5s^2\,5p^4$	$5p^4\;{}^3P$	2	0	−7090	
		1	7090	639	
		0	6451		
$5s^2\,5p^4$	$5p^4\;{}^1D$	2	13731		
$5s^2\,5p^4$	$5p^4\;{}^1S$	0	32629		
$5s^2\,5p^3(^4S^\circ)6s$	$6s\;{}^5S^\circ$	2	*81040.12*		1.86
$5s\,5p^5$	$5p^5\;{}^3P^\circ$	2	*81915.20*	−2314.42	1.54
		1	*84229.62*	−1161.98	1.530
		0	*85391.60*		0/0
$5s^2\,5p^3(^4S^\circ)6s$	$6s\;{}^3S^\circ$	1	*84850.29*		1.753
$5s^2\,5p^3(^4S^\circ)5d$	$5d\;{}^5D^\circ$	4	*86043.66*	308.27	1.480
		3	*85735.39*	−436.89	1.457
		2	*86172.28*	−1569.19	1.434
		1	*87741.47*	−2670.93	1.472
		0	*90412.40*		0/0
$5s^2\,5p^3(^4S^\circ)5d$	$5d\;{}^3D^\circ$	3	*93013.39*	2507.63	1.35
		2	*90505.76*	−4326.99	1.138
		1	*94832.75*		0.653

I II

Config.	Desig.	J	Level	Interval	Obs. g
$5s^2\,5p^3(^2D^\circ)6s$	$6s'\;{}^3D^\circ$	1	*92140.04*	1558.74	0.685
		2	*93698.78*	2959.26	1.16
		3	*96658.04*		1.36
$5s\,5p^5$	$5p^5\;{}^1P^\circ$	1	*95963.31*		1.05
$5s^2\,5p^3(^2D^\circ)5d$	$5d'\;{}^3D^\circ$	1			
		2	*97090.73*	2859.76	1.26
		3	*99950.49*		
$5s^2\,5p^3(^2D^\circ)6s$	$6s'\;{}^1D^\circ$	2	*97708.27*		0.996
$5s^2\,5p^3(^2D^\circ)5d$	$5d'\;{}^3F^\circ$	2			
		3	*98183.18*	1201.78	1.24?
		4	*99384.96*		
$5s^2\,5p^3(^4S^\circ)6p$	$6p\;{}^5P$	1	99226.99	107.54	2.309
		2	99334.53	1075.47	1.714
		3	100410.00		1.622
$5s^2\,5p^3(^2D^\circ)5d$	$5d'\;{}^1G^\circ$	4	*101165.25*		
$5s^2\,5p^3(^4S^\circ)6p$	$6p\;{}^3P$	2	102620.89	969.30	1.501
		1	101651.59	−1359.88	1.520
		0	103011.47		0/0

I II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$5s^2\,5p^3(^2P^\circ)6s$	$6s''\ ^3P^\circ$	0 1 2	 106071 107519.18	1448	 1.39
$5s^2\,5p^3(^2P^\circ)6s$	$6s''\ ^1P^\circ$	1	107628.58		
$5s^2\,5p^3(^2D^\circ)5d$	$5d'\ ^3P^\circ$	0 1 2	 108544.96		 1.45
$5s^2\,5p^3(^2P^\circ)5d$	$5d''\ R^\circ$	1	109308.77		
$5s^2\,5p^3(^2D^\circ)6p$	$6p'\ ^1P$	1	110014.15		0.915
$5s^2\,5p^3(^2P^\circ)5d$	$5d''\ Y^\circ$	2	110466.48		1.36
$5s^2\,5p^3(^2D^\circ)6p$	$6p'\ ^3F$	2 3 4	111305.50 115275.29 115361.39	3969.79 86.10	0.915 1.212 1.29
$5s^2\,5p^3(^2D^\circ)6p$	$6p'\ ^3D$	3 2 1	112426.46 112186.91 113820.24	239.55 −1633.33	1.12 1.158 0.985
$5s^2\,5p^3(^2D^\circ)6p$	$6p'\ ^1F$	3	114164.65		1.13
$5s^2\,5p^3(^2P^\circ)5d$	$5d''\ O^\circ$	2	114490.00		
$5s^2\,5p^3(^2D^\circ)6p$	$6p'\ ^3P$	0 1 2	114643.21 116092.24 115715.90	1449.03 −376.34	0/0 1.39 1.425
$5s^2\,5p^3(^2P^\circ)5d$	$5d''\ Z^\circ$	2	117942.70		1.38?
$5s^2\,5p^3(^4S^\circ)7s$	$7s\ ^5S^\circ$	2	118614.91		1.894
$5s^2\,5p^3(^2D^\circ)6p$	$6p'\ ^1D$	2	119090.24		1.11
$5s^2\,5p^3(^4S^\circ)7s$	$7s\ ^3S^\circ$	1	119896.14		
$5s^2\,5p^3(^2P^\circ)5d$	$5d''\ ^3P^\circ$	0 1 2	 121083.11		 1.443
$5s^2\,5p^3(^2P^\circ)5d$	$5d''\ ^3D^\circ$	3 2 1	121202.92 126146.15?	−4943.23	1.17 1.18
$5s^2\,5p^3(^4S^\circ)6d$	$6d\ ^5D^\circ$	0 1 2 3 4	121709.05 122250.90 121826.02 121785.70 121833.41	541.85 −424.88 −40.32 47.71	0/0 1.466 1.453 1.424 1.45
$5s^2\,5p^3(^2P^\circ)5d$	$5d''\ U^\circ$	3	123587.33		
$5s^2\,5p^3(^4S^\circ)5f$	$5f\ ^5F$	5 4 3 2 1	124749.64 124691.29 124719.30 124790.59 124849.26	58.35 −28.01 −71.29 −58.67	
$5s^2\,5p^3(^4S^\circ)7p$	$7p\ ^5P$	1 2 3	124958.36 125091.79 125490.94	133.43 399.15	
$5s^2\,5p^3(^4S^\circ)5f$	$5f\ ^3F$	2 3 4	125229.61 125234.37 125484.51	4.76 250.14	0.83
$5s^2\,5p^3(^4S^\circ)6d$	$6d\ ^3D^\circ$	3 2 1	125295.68 125254.88 125346.42	40.80 −91.54	1.28 1.095 0.674
$5s^2\,5p^3(^2P^\circ)6p$	$6p''\ ^3D$	1 2 3	 125532.05 129438.75	3906.70	 0.83 1.32
$5s^2\,5p^3(^2D^\circ)7s$	$7s'\ ^3D^\circ$	1 2 3	127897		0.89

Config.	Desig.	J	Level	Interval	Obs. g
$5s^2\,5p^3(^2P^\circ)6p$	$6p''\ ^3S$	1	128570.61		1.73
$5s^2\,5p^3(^2P^\circ)6p$	$6p''\ y$	1	129780.20		
$5s^2\,5p^3(^2D^\circ)6d$ or $5s^2\,5p^3(^2D^\circ)7s$	k°	1	130622.62		
	l°	2	130624.98		
$5s^2\,5p^3(^2P^\circ)6p$	$6p''\ ^3P$	0 1 2	 131452.20		 1.26
$5s^2\,5p^3(^4S^\circ)8s$	$8s\ ^5S^\circ$	2	132844.61		
$5s^2\,5p^3(^4S^\circ)8s$	$8s\ ^3S^\circ$	1	133304.47		
$5s^2\,5p^3(^2D^\circ)6d$ or $5s^2\,5p^3(^2D^\circ)7s$	a°	3	133557.94		1.23
	b°	3	133962.93		1.16
	c°	3	134031.30		0.81
	d°	2	134044.52		1.02
$5s^2\,5p^3(^2D^\circ)6d$	$6d'\ ^1S^\circ$	0	134243.37		0/0
$5s^2\,5p^3(^4S^\circ)7d$	$7d\ ^5D^\circ$	4 3 2 1 0	134509.75 134449.09 134554.39	60.66	
$5s^2\,5p^3(^2D^\circ)6d$	$6d'\ ^3D^\circ$	1 2 3	 134967.58 135592.36	624.78	
$5s^2\,5p^3(^2D^\circ)7p$	$7p'\ ^1P$	1	135350.02		
$5s^2\,5p^3(^2D^\circ)7p$	$7p'\ ^3F$	2 3 4	135691.17 139698.67 139507.13	4007.6 −191.54	
$5s^2\,5p^3(^2D^\circ)7p$	$7p'\ ^3D$	3 2 1	136104.20 136415.92 136871.44	−311.72 −455.52	
$5s^2\,5p^3(^2D^\circ)7p$ or $5s^2\,5p^3(^2D^\circ)5f$		1	136534.34		
		3	136708.04		
$5s^2\,5p^3(^2D^\circ)6d$ or $5s^2\,5p^3(^2D^\circ)7s$	e°	4	136740.86		1.21
	f°	3	137512.54		1.24
	g°	2	138323.94		1.27
		2	137021.77		
$5s^2\,5p^3(^2D^\circ)6d$	$6d'\ ^3P^\circ$	0 1 2	138371.5?		0/0
$5s^2\,5p^3(^2D^\circ)7p$	$7p'\ ^1F$	3	139225.07		
$5s^2\,5p^3(^2D^\circ)6d$ or $5s^2\,5p^3(^2D^\circ)7s$	h°	2	139559.17		1.09
	i°	2	139641.52		1.04
$5s^2\,5p^3(^2D^\circ)7p$	$7p'\ ^3P$	2 1 0	139918.97 140044.25	−125.28	
$5s^2\,5p^3(^4S^\circ)9s$	$9s\ ^5S^\circ$	2	139965.27		
$5s^2\,5p^3(^4S^\circ)9s$	$9s\ ^3S^\circ$	1	140133.05		
		2	140196.75		
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I III ($^4S_{1\frac{1}{2}}$)	*Limit*	-----	154050		

December 1957.

I II Observed Terms*

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}+$	Observed Terms			
$5s^2\,5p^4$	$5p^4\ {}^1S$ $5p^4\ {}^3P$ $5p^4\ {}^1D$			
$5s\,5p^5$	$5p^5\ {}^3P^\circ$ $5p^5\ {}^1P^\circ$			
	$ns\ (n\geq 6)$	$np\ (n\geq 6)$	$nd\ (n\geq 5)$	$nf\ (n\geq 4)$
$5s^2\,5p^3(^4S^\circ)nx$	$6,$ to $9s\ {}^5S^\circ$ $6,$ to $9s\ {}^3S^\circ$	$6, 7p\ {}^5P$ $6p\ {}^3P$	5 to $7d\ {}^5D^\circ$ $5, 6d\ {}^3D^\circ$	$5f\ {}^5F$ $5f\ {}^3F$
$5s^2\,5p^3(^2D^\circ)nx'$	$6, 7s'\ {}^3D^\circ$ $6s'\ {}^1D^\circ$	$6, 7p'\ {}^3P$ $6, 7p'\ {}^3D$ $6, 7p'\ {}^3F$ $6, 7p'\ {}^1P$ $6p'\ {}^1D$ $6, 7p'\ {}^1F$	$6d'\ {}^3S^\circ$ $5, 6d'\ {}^3P^\circ$ $5, 6d'\ {}^3D^\circ$ $5d'\ {}^3F^\circ$ $5d'\ {}^1G^\circ$	
$5s^2\,5p^3(^2P^\circ)nx''$	$6s''\ {}^3P^\circ$ $6s''\ {}^1P^\circ$	$6p''\ {}^3S$ $6p''\ {}^3P$ $6p''\ {}^3D$	$5d''\ {}^3P^\circ$ $5d''\ {}^3D^\circ$	

*For predicted terms in the spectrum of the Te I isoelectronic sequence, see Vol. III, Introduction.

I III

(Sb I sequence; 51 electrons) $Z=53$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,5s^2\,5p^3\ {}^4S^\circ_{1\frac{1}{2}}$

$5p^3\ {}^4S^\circ_{1\frac{1}{2}}$ K I. P. volts

Seth has reported 20 levels, based on measurements by L. and E. Bloch, which he assigns to $6s$, $6p$, and $5d$ electrons. In the 1949 reference below it is stated that a few additional levels, and possibly two series members are known. Spectrograms of I III covering a long spectral range are needed to confirm and extend the present work on analysis.

REFERENCES

J. B. Seth, Proc. Indian Acad. Sci. 1A, 593 (1935). (T) (C L)
S. G. Krishnamurty and T. V. Parthasaradhy, Nature 164, 407 (1949).

October 1953.

I IV

(Sn I sequence; 50 electrons) $Z=53$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,5s^2\,5p^2\;{}^3P_0$

$5p^2\;{}^3P_0$ K I. P. volts

This spectrum has not been adequately investigated. Krishnamurty has reported 68 lines between 2224.43 A and 3546.90 A, half of which he has classified as combinations among 9 even levels and 10 odd levels. By a comparison of isoelectronic data he assigns some term designations and assumes an arbitrary absolute value of 192000.0 K for $6s\;{}^3P_2^\circ$. Accurate measurements in the short-wave region are needed to establish the ground term and extend the study. Lacking these, the writer has made a crude extrapolation that places $6s\;{}^3P_2^\circ$ roughly 154000 K above the ground state zero. She estimates the value of the limit as approximately 345000 K, and the ionization potential as roughly 43 ± volts. The error in all these estimates is probably large.

REFERENCE

S. G. Krishnamurty, Proc. Phys. Soc. London 48, 277 (1936). (T) (C L)

August 1953.

I VI

(Cd I sequence; 48 electrons) $Z=53$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,5s^2\;{}^1S_0$

$5s^2\;{}^1S_0$ K I. P. volts

Krishnamurty and Fernando have utilized measurements by L. and E. Bloch to work out an array of 6 multiplets from 17 lines in the range 483 A to 919 A. They suggest combinations giving intervals for the $5p\;{}^3P^\circ$ term that are not inconsistent with those extrapolated along the sequence. Confirmation is needed.

REFERENCE

S. G. Krishnamurty and I. Fernando, Indian J. Phys. 23, 172 (1949). (C L)

August 1953.

I VII

(Ag I sequence; 47 electrons) $Z=53$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,5s\ ^2S_{0\frac{1}{2}}$

$5s\ ^2S_{0\frac{1}{2}}$ K I. P. volts

Little is known about this spectrum. Five lines measured by L. Bloch, E. Bloch, and N. Felici have been attributed to I VII and classified by Fernando. The terms have been worked out by the writer from these lines.

REFERENCES

L. Bloch, E. Bloch, et N. Felici, J. Phys. Rad. [7] 8, No. 9, 355 (1937).
I. Fernando, Current Sci. 17, 362 (1948). (C L)

I VII

Config.	Desig.	J	Level	Interval
$4d^{10}(^1S)5s$	$5s\ ^2S$	$0\frac{1}{2}$	0	
$4d^{10}(^1S)5p$	$5p\ ^2P^\circ$	$0\frac{1}{2}$ $1\frac{1}{2}$	*104960* *119960*	15000
$4d^{10}(^1S)5d$	$5d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	274020 276250	2230

March 1953.

I VIII

(Pd I sequence; 46 electrons) $Z=53$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\ ^1S_0$

$4d^{10}\ ^1S_0$ 1370370 K I. P. 170 volts

Kruger and Shoupp have classified three lines between 190 A and 196 A as combinations with the ground term, and determined the limit from a study of the Moseley diagram of the isoelectronic sequence. The writer has rounded off their term values, and assigned the J-value of the parent term by analogy with Pd I. Two of the lines have been classified independently in the 1937 paper listed below. The quoted ionization potential may be in error by several volts.

REFERENCES

P. G. Kruger and W. E. Shoupp, Phys. Rev. 46, 124 (1934). (I P) (T) (C L)
L. Bloch, E. Bloch et N. Felici, J. Phys. Rad. [7] 8, 362 (1937). (C L)

I VIII

Config.	Desig.	J	Level
$4d^{10}$	$4d^{10}\ ^1S$	0	0
$4d^9(^2D_{2\frac{1}{2}})5p$	$5p\ ^3P^\circ$	2 1 0	*508770*
$4d^9(^2D_{1\frac{1}{2}})5p$	$5p\ ^1P^\circ$	1	*515060*
$4d^9(^2D_{1\frac{1}{2}})5p$	$5p\ ^3D^\circ$	3 2 1	*525880*
I IX $(^2D_{2\frac{1}{2}})$	*Limit*	----------	[1370370]

March 1953.

XENON

Xe I

54 electrons $Z=54$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,5s^2\,5p^6\,{}^1S_0$

$5p^6\,{}^1S_0$ 97834.4 K I. P. 12.127 volts

The observations of Xe I extend from 926 A to 21048 A. Those in the infrared region beyond the photographic limit are listed in the 1949 and 1952 references by Sittner and Peck, and by Humphreys and Kostkowski, respectively. The ultraviolet observations have been extended by Beutler to 926 A, *i. e.* beyond the limit, 1192 A, reached by Boyce.

The energy levels have been taken from an unpublished manuscript kindly furnished by Edlén, who has made a critical study of the published papers on Xe I. Most of the levels are listed in the extensive term array given by Humphreys and Meggers in 1933. Three-place entries are from interferometric measurements. Predicted values, furnished by Edlén, are in brackets.

The observed *g*-values are from the 1941 paper, by Green, Hurlburt, and Bowman. Pogány has also published a shorter list of *g*-values.

The limit given by Boyce, 97834.4 K, has been used for the present compilation. The other levels are relative to the absolute value of $6s[1\tfrac{1}{2}]^\circ_2=30766.353$, adopted by Humphreys and Meggers.

White has discussed the effect of autoionization on the appearance of higher series members having the limit ${}^2P^\circ_{0\frac{1}{2}}$. Beutler has observed a number of these lines in absorption. The levels $ns'[0\tfrac{1}{2}]^\circ$, $n=8$ to 12 and $nd'[1\tfrac{1}{2}]^\circ$, $n=6$ to 18, are from his paper. The separation of the two limits ${}^2P^\circ_{1\frac{1}{2}}-{}^2P^\circ_{0\frac{1}{2}}$ as observed by Edlén (1944) in Xe II is 10537.01 K.

The Paschen notation is entered in the first column of the table. The letters X, Y, T, Z, U, V, and W, adopted when configurations involving *f*-electrons were found, are also included in this column.

As for the other inert gases, Edlén has suggested a pair-coupling notation to take into account the departure from *LS*-coupling. By analogy with the other inert gas spectra, and by taking into account the general run of the observed *g*-values, the writer has assigned the following provisional *LS*-designations, although they have little, if any, significance in most cases.

Paschen	Desig.	Paschen	Desig.	Paschen	Desig.
$(n-5)s_5$	$ns\,{}^3P^\circ_2$	$3-7d_6$	$5-9d\,{}^3P^\circ_0$	$3s_1''''$	$5d\,{}^3D^\circ_2$
$(n-5)s_4$	$ns\,{}^3P^\circ_1$	$3-7d_5$	$5-9d\,{}^3P^\circ_1$	$3s_1''$	$5d\,{}^1D^\circ_2$
$(n-5)s_3$	$ns\,{}^3P^\circ_0$	$3-7d_3$	$5-9d\,{}^3P^\circ_2$	$3s_1'''$	$5d\,{}^3D^\circ_3$
$(n-5)s_2$	$ns\,{}^1P^\circ_1$	$3-7d_4'$	$5-9d\,{}^3F^\circ_4$	$3s_1'$	$5d\,{}^3D^\circ_1$
		$3-9d_4$	$5-11d\,{}^3F^\circ_3$		
$2-4p_{10}$	$6-8p\,{}^3S_1$	$3-7d_1''$	$5-9d\,{}^3F^\circ_2$	$4-6X$	$4-6f\,{}^3D_1$
$2-4p_9$	$6-8p\,{}^3D_3$	$3-7d_1'$	$5-9d\,{}^1F^\circ_3$	$4-6Y$	$4-6f\,{}^3D_2$
$2-5p_8$	$6-9p\,{}^3D_2$	$3-7d_2$	$5-9d\,{}^1P^\circ_1$	$4-6U$	$4-6f\,{}^3D_3$
$2-4p_7$	$6-8p\,{}^3D_1$			$4-6V$	$4-6f\,{}^1D_2$
$2-5p_6$	$6-9p\,{}^1D_2$				
$2-5p_5$	$6-9p\,{}^3P_0$				

Xe I—Continued

The *Jl*-coupling notation in the general form suggested by Racah is here adopted, and the arrangement is similar to that used for Ne I, A I, and Kr I. Because of the wide interval of the parent term, the high levels observed by Beutler might more appropriately be entered after the first ionization limit, as has been suggested by Edlén. In the general form of presentation adopted in these Volumes for noble gas spectra they stand out so conspicuously, however, that no exception in arrangement has been made for Xe I.

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Xe I

Paschen	Config.	Desig.	J	Level	Obs. g
p_0	$5p^6$	$5p^6\ ^1S$	0	0.0	
$1s_5$	$5p^5(^2P^\circ_{1\frac{1}{2}})6s$	$6s\ [1\frac{1}{2}]^\circ$	2	*67068.047*	1.500
$1s_4$			1	*68045.663*	1.204
$1s_3$	$5p^5(^2P^\circ_{\frac{1}{2}})6s$	$6s'\ [0\frac{1}{2}]^\circ$	0	*76197.292*	0/0
$1s_2$			1	*77185.560*	1.321
$2p_{10}$	$5p^5(^2P^\circ_{1\frac{1}{2}})6p$	$6p\ [0\frac{1}{2}]$	1	77269.649	1.852
$2p_9$	"	$6p\ [2\frac{1}{2}]$	2	78120.303	1.106
$2p_8$			3	78403.562	1.336
$2p_7$	"	$6p\ [1\frac{1}{2}]$	1	78956.538	1.022
$2p_6$			2	79212.970	1.379
$2p_5$	"	$6p\ [0\frac{1}{2}]$	0	80119.474	0/0
$2p_4$	$5p^5(^2P^\circ_{\frac{1}{2}})6p$	$6p'\ [1\frac{1}{2}]$	1	88379.647	0.790
$2p_3$			2	89162.880	1.195
$2p_2$	"	$6p'\ [0\frac{1}{2}]$	1	89279.233	1.552
$2p_1$			0	89860.538	0/0
$3d_6$	$5p^5(^2P^\circ_{1\frac{1}{2}})5d$	$5d\ [0\frac{1}{2}]^\circ$	0	*79771.798*	
$3d_5$			1	*79987.16*	1.395
$3d'_4$	"	$5d\ [3\frac{1}{2}]^\circ$	4	*80197.16*	
$3d_4$			3	*80970.93*	
$3d_3$	"	$5d\ [1\frac{1}{2}]^\circ$	2	*80323.28*	1.376
$3d_2$			1	*83890.47*	
$3d''_1$	"	$5d\ [2\frac{1}{2}]^\circ$	2	*81926.04*	
$3d'_1$			3	*82430.72*	

Xe I

Paschen	Config.	Desig.	J	Level	Obs. g
$3s''''_1$	$5p^5(^2P^\circ_{\frac{1}{2}})5d$	$5d'\ [1\frac{1}{2}]^\circ$	2	*91447.99*	1.274
$3s'_1$			1	*93618.75*	
$3s''_1$	"	$5d'\ [2\frac{1}{2}]^\circ$	2	*91153.16*	
$3s'''_1$			3	*91747.070*	1.126
$2s_5$	$5p^5(^2P^\circ_{1\frac{1}{2}})7s$	$7s\ [1\frac{1}{2}]^\circ$	2	*85189.31*	
$2s_4$			1	*85440.53*	
$2s_3$	$5p^5(^2P^\circ_{\frac{1}{2}})7s$	$7s'\ [0\frac{1}{2}]^\circ$	0	*95721.46*	
$2s_2$			1	*95801.092*	1.308
$3p_{10}$	$5p^5(^2P^\circ_{1\frac{1}{2}})7p$	$7p\ [0\frac{1}{2}]$	1	87927.652	1.728
$3p_9$	"	$7p\ [2\frac{1}{2}]$	2	88352.201	1.123
$3p_8$			3	88469.732	1.348
$3p_7$	"	$7p\ [1\frac{1}{2}]$	1	88745.081	0.903
$3p_6$			2	88687.020	1.347
$3p_5$	"	$7p\ [0\frac{1}{2}]$	0	88842.781	0/0
$4d_6$	$5p^5(^2P^\circ_{1\frac{1}{2}})6d$	$6d\ [0\frac{1}{2}]^\circ$	0	*88491.52*	
$4d_5$			1	*88550.28*	
$4d'_4$	"	$6d\ [3\frac{1}{2}]^\circ$	4	*88912.195*	
$4d_4$			3	*89025.39*	
$4d_3$	"	$6d\ [1\frac{1}{2}]^\circ$	2	*88708.96*	
$4d_2$			1	*90032.65*	
$4d''_1$	"	$6d\ [2\frac{1}{2}]^\circ$	2	*89243.75*	
$4d'_1$			3	*89535.05*	

Xe I—Continued

Paschen	Config.	Desig.	J	Level	Obs. g
$4s_1'$	$5p^5(^2P_{\frac{1}{2}})6d$	$6d'$ [1½]°	2		
			1	*100418*	
$3s_5$	$5p^5(^2P_{1\frac{1}{2}})8s$	$8s$ [1½]°	2	*90805.045*	1.465
$3s_4$			1	*90932.939*	1.182
	$5p^5(^2P_{\frac{1}{2}})8s$	$8s'$ [0½]°	0		
$3s_2$			1	*101496*	
4X	$5p^5(^2P_{1\frac{1}{2}})4f$	$4f$ [1½]	1	90840.300	0.504
4Y			2	90849.968	1.11
4T	"	$4f$ [4½]	5	90861.18	
4Z			4	90862.03	
4U	"	$4f$ [2½]	3	90907.614	1.18
4V			2	90910.583	0.86
4W	"	$4f$ [3½]	3	90944.55	
			4	90944.65	
$4p_{10}$	$5p^5(^2P_{1\frac{1}{2}})8p$	$8p$ [0½]	1	92153.809	1.801
$4p_9$	"	$8p$ [2½]	2	92221.884	1.103
$4p_8$			3	92265.470	1.272
$4p_7$	"	$8p$ [1½]	1	92333.588	1.036
$4p_6$			2	92371.442	1.395
$4p_5$	"	$8p$ [0½]	0	92555.659	0/0
$5d_6$	$5p^5(^2P_{1\frac{1}{2}})7d$	$7d$ [0½]°	0	*92960.449*	0/0
$5d_5$			1	*93128.795*	1.273
$5d_4'$	"	$7d$ [3½]°	4	*92445.434*	1.217
$5d_4$			3	*92646.635*	1.026
$5d_3$	"	$7d$ [1½]°	2	*92722.043*	1.196
$5d_2$			1	*92714.555*	0.819
$5d_1''$	"	$7d$ [2½]°	2	*92679.032*	1.073
$5d_1'$			3	*92734.107*	1.263
	$5p^5(^2P_{\frac{1}{2}})7d$	$7d'$ [1½]°	2		
$5s_1'$			1	*103419*	
5X	$5p^5(^2P_{1\frac{1}{2}})5f$	$5f$ [1½]	1	93363.199	0.50
5Y			2	93366.764	1.10
5T	"	$5f$ [4½]	5	93378.01	
5Z			4	93378.70	
5U	"	$5f$ [2½]	3	93401.96	1.17
5V			2	93404.484	0.87
5W	"	$5f$ [3½]	3	93421.30	
			4	93421.40	
$4s_5$	$5p^5(^2P_{1\frac{1}{2}})9s$	$9s$ [1½]°	2	*93398.758*	1.496
$4s_4$			1	*93422.615*	1.154
	$5p^5(^2P_{\frac{1}{2}})9s$	$9s'$ [0½]°	0		
$4s_2$			1	*103954*	
$5p_{10}$	$5p^5(^2P_{1\frac{1}{2}})9p$	$9p$ [0½]	1	94067.46	
$5p_9$	"	$9p$ [2½]	2	94110.66	
$5p_8$			3	94135.04	1.307
$5p_7$	"	$9p$ [1½]	1	94169.37	
$5p_6$			2	94190.75	1.386
$5p_5$	$5p^5(^2P_{1\frac{1}{2}})9p$	$9p$ [0½]	0	94286.01	0/0
$6d_6$	$5p^5(^2P_{1\frac{1}{2}})8d$	$8d$ [0½]°	0	*94184.869*	0/0
$6d_5$			1	*94228.583*	1.180
$6d_4'$	"	$8d$ [3½]°	4	*94296.835*	1.236
$6d_4$			3	*94290.735*	1.076
$6d_3$	"	$8d$ [1½]°	2	*94286.168*	1.303
$6d_2$			1	*94685.94*	0.914
$6d_1''$	"	$8d$ [2½]°	2	*94339.949*	0.987
$6d_1'$			3	*94370.504*	1.246
	$5p^5(^2P_{\frac{1}{2}})8d$	$8d'$ [1½]°	2		
$6s_1'$			1	*105089*	
6X	$5p^5(^2P_{1\frac{1}{2}})6f$	$6f$ [1½]	1	94735.411	0.50
6Y			2	94737.654	1.09
6T	"	$6f$ [4½]	5	94744.73	
6Z			4	94745.17	
6U	"	$6f$ [2½]	3	94758.58	1.17
6V			2	94760.415	0.87
6W	"	$6f$ [3½]	3	94769.90	
			4	94769.99	
$5s_5$	$5p^5(^2P_{1\frac{1}{2}})10s$	$10s$ [1½]°	2	*94760.431*	1.512
$5s_4$			1	*94787.603*	1.164
	$5p^5(^2P_{\frac{1}{2}})10s$	$10s'$ [0½]°	0		
$5s_2$			1	[*105316*]	
$6p_{10}$	$5p^5(^2P_{1\frac{1}{2}})10p$	$10p$ [0½]	1	95154.88	
$6p_9$	"	$10p$ [2½]	2	95182.17	
$6p_8$			3	95197.04	
$6p_7$	"	$10p$ [1½]	1	95216.97	
$6p_6$			2	95230.10	
$6p_5$	"	$10p$ [0½]	0	95286.57	
$7d_6$	$5p^5(^2P_{1\frac{1}{2}})9d$	$9d$ [0½]°	0	*95180.107*	0/0
$7d_5$			1	*95228.913*	1.217
$7d_4'$	"	$9d$ [3½]°	4	*95250.456*	1.237
$7d_4$			3	*95283.528*	1.078
$7d_3$	"	$9d$ [1½]°	2	*95274.939*	1.298
$7d_2$			1	*95498.99*	0.899
$7d_1''$	"	$9d$ [2½]°	2	*95313.919*	0.980
$7d_1'$			3	*95335.225*	1.225
	$5p^5(^2P_{\frac{1}{2}})9d$	$9d'$ [1½]°	2		
$7s_1'$			1	*105965*	
7X	$5p^5(^2P_{1\frac{1}{2}})7f$	$7f$ [1½]	1	95561.582	
7Y			2	95563.079	
7T	"	$7f$ [4½]	5	95567.65	
7Z			4	95567.99	
7U	"	$7f$ [2½]	3	95576.44	
7V			2	95577.71	
7W	"	$7f$ [3½]	3	95583.59	
			4	95583.67	

Xe I—Continued

Paschen	Config.	Desig.	J	Level	Obs. g
$6s_5$	$5p^5(^2P_{1\frac{1}{2}})11s$	$11s$ [1½]°	2	*95579.469*	
$6s_4$			1	*95591.48*	1.188
	$5p^5(^2P_{0\frac{1}{2}})11s$	$11s'$ [0½]°	0		
$6s_2$			1	*106157*	
$7p_{10}$	$5p^5(^2P_{1\frac{1}{2}})11p$	$11p$ [0½]	1	[95831.3]	
$7p_9$	"	$11p$ [2½]	2	[95849.1]	
$7p_8$			3	95858.60	
$7p_7$	"	$11p$ [1½]	1	95871.20	
$7p_6$			2	95879.91	
$7p_5$	"	$11p$ [0½]	0	95916.04	
$8d_6$	$5p^5(^2P_{1\frac{1}{2}})10d$	$10d$ [0½]°	0	*95896.76*	
$8d_5$			1	*95913.388*	
$8d_4'$	"	$10d$ [3½]°	4	*95892.702*	
$8d_4$			3	*95912.523*	1.081
$8d_3$	"	$10d$ [1½]°	2	*95905.108*	
$8d_2$			1	*96046.28*	
$8d_1''$	"	$10d$ [2½]°	2	*95932.31*	
$8d_1'$			3	*95947.123*	
	$5p^5(^2P_{0\frac{1}{2}})10d$	$10d'$ [1½]°	2		
$8s_1'$			1	*106542*	
8X	$5p^5(^2P_{1\frac{1}{2}})8f$	$8f$ [1½]	1	96096.76	
8Y			2	96097.82	
8T	"	$8f$ [4½]	5	96101.11	
8Z			4	96101.26	
8U	"	$8f$ [2½]	3	96106.82	
8V			2	96107.87	
8W	"	$8f$ [3½]	3	96111.68	
			4	96111.75	
$7s_5$	$5p^5(^2P_{1\frac{1}{2}})12s$	$12s$ [1½]°	2	*96109.73*	
$7s_4$			1	*96123.28*	
	$5p^5(^2P_{0\frac{1}{2}})12s$	$12s'$ [0½]°	0		
$7s_2$			1	[*106658*]	
$8p_{10}$	$5p^5(^2P_{1\frac{1}{2}})12p$	$12p$ [0½]	1	[96280.1]	
$8p_9$	"	$12p$ [2½]	2	[96292.6]	
$8p_8$			3	96299.46	
$8p_7$	"	$12p$ [1½]	1	96307.37	
$8p_6$			2	96313.40	
$8p_5$	"	$12p$ [0½]	0	96338.33	
$9d_6$	$5p^5(^2P_{1\frac{1}{2}})11d$	$11d$ [0½]°	0	*96305.13*	
$9d_5$			1	*96315.67*	
$9d_4'$	"	$11d$ [3½]°	4	*96322.06*	
$9d_4$			3	*96334.987*	1.082
$9d_3$	"	$11d$ [1½]°	2	*96329.13*	
$9d_2$			1	*96424.28*	
$9d_1''$	"	$11d$ [2½]°	2	*96343.54*	
$9d_1'$			3	*96359.07*	
	$5p^5(^2P_{0\frac{1}{2}})11d$	$11d'$ [1½]°	2		
$9s_1'$			1	*106939*	
9X	$5p^5(^2P_{1\frac{1}{2}})9f$	$9f$ [1½]	1	96463.14	
9Y			2	96463.78	
9T	"	$9f$ [4½]	5	96466.14	
9Z			4	96466.23	
9U	"	$9f$ [2½]	3	96470.24	
9V			2	96470.90	
9W	"	$9f$ [3½]	3, 4	96473.66	
$8s_5$	$5p^5(^2P_{1\frac{1}{2}})13s$	$13s$ [1½]°	2	*96472.64*	
$8s_4$			1	*96481.13*	
	$5p^5(^2P_{1\frac{1}{2}})13p$	$13p$ [2½]	2		
$9p_8$			3	96607.28	
$9p_7$	"	$13p$ [1½]	1		
$9p_6$			2	96617.41	
$9p_5$	"	$13p$ [0½]	0	96634.60	
$10d_6$	$5p^5(^2P_{1\frac{1}{2}})12d$	$12d$ [0½]°	0	[*96609.5*]	
$10d_5$			1	*96616.73*	
$10d_4'$	"	$12d$ [3½]°	4	*96623.31*	
$10d_4$			3	*96632.14*	
$10d_3$	"	$12d$ [1½]°	2	*96627.59*	
$10d_2$			1	*96694.90*	
$10d_1''$	"	$12d$ [2½]°	2	*96641.85*	
$10d_1'$			3	*96649.57*	
	$5p^5(^2P_{0\frac{1}{2}})12d$	$12d'$ [1½]°	2		
$10s_1'$			1	*107216*	
10X	$5p^5(^2P_{1\frac{1}{2}})10f$	$10f$ [1½]	1	} *96725.0*	
10Y			2		
10T	"	$10f$ [4½]	5	96726.98	
10Z			4	96727.07	
10U	"	$10f$ [2½]	3	96730.00	
10V			2	[96730.5]	
10W	"	$10f$ [3½]	3	[96732.5]	
$9s_5$	$5p^5(^2P_{1\frac{1}{2}})14s$	$14s$ [1½]°	2	*96731.83*	
$9s_4$			1	[*96737.9*]	
	$5p^5(^2P_{1\frac{1}{2}})14p$	$14p$ [2½]	2		
$10p_8$			3	96830.65	
	"	$14p$ [1½]	1		
$10p_6$			2	96837.65	
$11d_4'$	$5p^5(^2P_{1\frac{1}{2}})13d$	$13d$ [3½]°	4	*96842.64*	
$11d_4$			3	*96849.10*	
$11d_1''$	"	$13d$ [2½]°	2	*96856.08*	
$11d_1'$			3	*96862.02*	
	$5p^5(^2P_{0\frac{1}{2}})13d$	$13d'$ [1½]°	2		
$11s_1'$			1	[*107434*]	
11T	$5p^5(^2P_{1\frac{1}{2}})11f$	$11f$ [4½]	5	} 96919.72	
11Z			4		
11U	"	$11f$ [2½]	3	96922.02	
			2		

Xe I—Continued

Paschen	Config.	Desig.	J	Level	Obs. g
$10s_5$	$5p^5(^2P_{1\frac{1}{2}})15s$	$15s\ [1\frac{1}{2}]^\circ$	2 1	*[96988.6]*	
$11p_9$	$5p^5(^2P_{1\frac{1}{2}})15p$	$15p\ [2\frac{1}{2}]$	2 3	96999.2	
$12d_4''$	$5p^5(^2P_{1\frac{1}{2}})14d$	$14d\ [3\frac{1}{2}]^\circ$	4 3	*97007.41*	
$12s_1'$	$5p^5(^2P_{0\frac{1}{2}})14d$	$14d'\ [1\frac{1}{2}]^\circ$	2 1	*107583*	
	Xe II $(^2P_{1\frac{1}{2}})$	*Limit*	-----	97834.4	

Xe I—Continued

Paschen	Config.	Desig.	J	Level	Obs. g
$13s_1'$	$5p^5(^2P_{0\frac{1}{2}})15d$	$15d'\ [1\frac{1}{2}]^\circ$	2 1	*107703*	
$14s_1'$	$5p^5(^2P_{0\frac{1}{2}})16d$	$16d'\ [1\frac{1}{2}]^\circ$	2 1	*107803*	
$15s_1'$	$5p^5(^2P_{0\frac{1}{2}})17d$	$17d'\ [1\frac{1}{2}]^\circ$	2 1	*107870*	
$16s_1'$	$5p^5(^2P_{0\frac{1}{2}})18d$	$18d'\ [1\frac{1}{2}]^\circ$	2 1	*107938*	
	Xe II $(^2P_{0\frac{1}{2}})$	*Limit*	-----	108371.4	

October 1956.

Xe I Observed Levels*

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$ $3d^{10}\ 4s^2\ 4p^6\ 4d^{10}+$	Observed Terms			
$5s^2\ 5p^6$	$5p^6\ ^1S$			
	$ns\ (n \geq 6)$	$np\ (n \geq 6)$	$nd\ (n \geq 5)$	$nf\ (n \geq 4)$
$5s^2\ 5p^5(^2P^\circ)nx$	{ 6–14s $^3P^\circ$ { 6–9, 11s $^1P^\circ$	6–8p ^3S 6–9p ^3P 6–9p ^3D 6p ^1S 6p ^1P 6–9p ^1D	5–9d $^3P^\circ$ 5d $^3D^\circ$ 5–11d $^3F^\circ$ 5–9d $^1P^\circ$ 5d $^1D^\circ$ 5–9d $^1F^\circ$	4–6f ^3D 4–6f ^1D
Jl–Coupling Notation				
	Observed Pairs			
	$ns\ (n \geq 6)$	$np\ (n \geq 6)$	$nd\ (n \geq 5)$	$nf\ (n \geq 4)$
$5s^2\ 5p^5(^2P_{1\frac{1}{2}})nx$	6–14s $[1\frac{1}{2}]^\circ$	6–13p $[0\frac{1}{2}]$ 6–15p $[2\frac{1}{2}]$ 6–14p $[1\frac{1}{2}]$	5–12d $[0\frac{1}{2}]^\circ$ 5–14d $[3\frac{1}{2}]^\circ$ 5–12d $[1\frac{1}{2}]^\circ$ 5–13d $[2\frac{1}{2}]^\circ$	4–9f $[1\frac{1}{2}]$ 4–11f $[4\frac{1}{2}]$ 4–11f $[2\frac{1}{2}]$ 4–9f $[3\frac{1}{2}]$
$5s^2\ 5p^5(^2P_{0\frac{1}{2}})nx'$	6–9, 11s' $[0\frac{1}{2}]^\circ$	6p' $[1\frac{1}{2}]$ 6p' $[0\frac{1}{2}]$	5d' $[2\frac{1}{2}]^\circ$ 5–12, 14–18d' $[1\frac{1}{2}]^\circ$	

*For predicted levels in the spectra of the Xe I isoelectronic sequence, see Vol. III, Introduction.

Xe II

(I I sequence; 53 electrons) $Z=54$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,5s^2\,5p^5\ ^2P^\circ_{1\frac{1}{2}}$

$5p^5\ ^2P^\circ_{1\frac{1}{2}}$ *171068.4* K I. P. 21.2 volts

The analysis is from Humphreys' 1939 paper with the revisions suggested in the 1939 paper on Zeeman Effect by Humphreys, Meggers, and de Bruin. More than 660 lines have been classified, including 20 in the ultraviolet from 740.406 A to 1244.756 A reported by Boyce, in addition to Humphreys' list, which extends from 2230.79 A to 10220.8 A.

Edlén attributes a line listed as Xe I at 9487.76 A to the forbidden transition giving the interval of the ground term of Xe II, namely, 10537.01 K. He states that the line is due to a magnetic-dipole transition and that the transition probability is 21 sec^{-1}.

The limit is "the approximate Rydberg limit of the s-electron series", the absolute term values being based on the $^4P_{2\frac{1}{2}}$ series.

The g-values in the table are from the paper by Humphreys, Meggers, and de Bruin, and from Angenetter. For the most part, they are average values of the various observers.

Observed intersystem combinations connect the doublet and quartet systems of terms.

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Xe II

Config.	Desig.	J	Level	Interval	Obs. g
$5s^2\,5p^5$	$5p^5\ ^2P^\circ$	1½	*0.0*	−10537.3	
		0½	*10537.3*		
$5s\,5p^6$	$5p^6\ ^2S$	0½	90873.83		2.02
$5s^2\,5p^4(^3P)6s$	$6s\ ^4P$	2½	93068.40	−1995.94	1.56
		1½	95064.34	−6093.17	1.38
		0½	101157.51		2.43
$5s^2\,5p^4(^3P)5d$	$5d\ ^4D$	3½	95437.60	40.92	1.38
		2½	95396.68	−636.76	1.34
		1½	96033.44	−824.70	1.18
		0½	96858.14		0.50
$5s^2\,5p^4(^3P)5d$	$5d\ ^4F$	4½	99404.90	582.24	1.31
		3½	98822.66	−2712.99	1.07
		2½	101535.65		
		1½			
$5s^2\,5p^4(^3P)6s$	$6s\ ^2P$	1½	102799.06	−1451.00	1.59
		0½	104250.06		0.56
$5s^2\,5p^4(^3P)5d$	$5d\ ^2P$	1½	105313.33	−634.21	1.15
		0½	105947.54		1.36

Xe II

Config.	Desig.	J	Level	Interval	Obs. g
$5s^2\,5p^4(^3P)5d$	$5d\ ^4P$	2½	106475.17	−906.58	
		1½	107381.75	475.64	0.67
		0½	106906.11		1.79
$5s^2\,5p^4(^3P)5d$	$5d\ ^2D$	1½	107904.50	1658.65	1.20
		2½	109563.15		1.33
$5s^2\,5p^4(^1D)6s$	$6s'\ ^2D$	2½	108007.25	−4917.45	1.22
		1½	112924.70		0.95
$5s^2\,5p^4(^1D)5d$	$5d'\ ^2D$	1½	111326.93	1376.65	1.24
		2½	112703.58		1.13
$5s^2\,5p^4(^3P)6p$	$6p\ ^4P^\circ$	2½	*111958.84*	166.76	1.47
		1½	*111792.08*	−1880.77	1.61
		0½	*113672.85*		1.50
$5s^2\,5p^4(^3P)6p$	$6p\ ^4D^\circ$	3½	*113705.33*	193.04	1.40
		2½	*113512.29*	−3270.82	1.28
		1½	*116783.11*	−3631.76	1.37
		0½	*120414.87*		0.56
$5s^2\,5p^4(^1D)5d$	$5d'\ ^2F$	2½	114751.08	162.88	1.10
		3½	114913.96		

Xe II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$5s^2\,5p^4(^1S)5d$	$5d''\ ^2D$	2½ 1½	119085. 50 124302. 18	−5216. 68	
$5s^2\,5p^4(^3P)6p$	$6p\ ^2S^\circ$	0½	*121179. 82*		2. 08
$5s^2\,5p^4(^3P)6p$	$6p\ ^4S^\circ$	1½	*121628. 80*		1. 28
$5s^2\,5p^4(^3P)6p$	$6p\ ^2D^\circ$	2½ 1½	*123112. 50* *124289. 50*	−1177. 00	1. 39 1. 32
$5s^2\,5p^4(^3P)6p$	$6p\ ^2P^\circ$	1½ 0½	*123254. 61* *124571. 02*	−1316. 41	1. 35 1. 16
$5s^2\,5p^4(^1S)6s$	$6s''\ ^2S$	0½	124070. 09		
$5s^2\,5p^4(^1D)5d$	$5d'\ ^2P$	0½ 1½	127010. 7 127527. 4	516. 7	
$5s^2\,5p^4(^1D)6p$	$6p'\ ^2F^\circ$	2½ 3½	*128867. 19* *130064. 03*	1196. 84	0. 92 1. 15
$5s^2\,5p^4(^1D)5d$	$5d'\ ^2S$	0½	129248. 5		
$5s^2\,5p^4(^1D)6p$	$6p'\ ^2P^\circ$	1½ 0½	*129667. 37* *131741. 09*	−2073. 72	1. 40 0. 71
$5s^2\,5p^4(^1D)6p$	$6p'\ ^2D^\circ$	1½ 2½	*131933. 76* *132207. 68*	273. 92	0. 90 1. 20
$5s^2\,5p^4(^3P)7s$	$7s\ ^4P$	2½ 1½ 0½	132518. 7 133189. 2 135060. 9	−670. 5 −1871. 7	1. 53 1. 40 2. 03
	2	0½	132916. 9		
	4	{0½ {1½	}133454. 2		
	6	2½	133915. 1		
$5s^2\,5p^4(^3P)6d$	$6d\ ^4D$	3½ 2½ 1½ 0½	135507. 2 135547. 0 135708. 2	−39. 8 −161. 2	1. 39 1. 33 1. 33
	16	1½	136509. 25		1. 68
	18	0½	136554. 17		0. 94
	8	2½	136569. 6		
$5s^2\,5p^4(^3P)6d$	$6d\ ^4F$	4½ 3½ 2½ 1½	 136597. 7 139094. 1 139640. 3	−2496. 4 −546. 2	 1. 14 1. 14 1. 14
	10	2½	136726. 5		
	1°	1½	*137269. 5*		
$5s^2\,5p^4(^1D)4f?$	$4f'\ ^2G^\circ$	3½ 4½	 *137318. 81*		
$5s^2\,5p^4(^1D)4f?$	$4f'\ ^2F^\circ$	2½ 3½	*137389. 18* *137493. 75*	104. 57	 1. 06
	12	1½	138062. 8		1. 00
	20	0½	138726. 4		1. 86
	3°	3½	*139005. 4*		
	5°	1½	*139128. 84*		
	7°	1½	*139182. 92*		
	9°	1½	*139498. 63*		
	11°	2½	*139646. 1*		
	13°	0½	*140011. 5*		
	15°	2½	*140030. 11*		1. 08
	17°	0½	*140185. 65*		
$5s^2\,5p^4(^1S)6p$	$6p''\ ^2P^\circ$	1½ 0½	*140210. 22*		
	19°	1½	*140335. 12*		
$5s^2\,5p^4(^3P)6d$	$6d\ ^4P$	0½ 1½ 2½	140883. 4 144140. 2 143399. 4	3256. 8 −740. 8	2. 25 0. 83 1. 19
	21°	1½	*140987. 0*		
$5s^2\,5p^4(^3P)7s$	$7s\ ^2P$	1½ 0½	142382. 2 142930. 0	−547. 8	1. 59 1. 05
	23°	1½	*143469. 8*		
$5s^2\,5p^4(^3P)6d$	$6d\ ^2D$	2½ 1½	144385. 0 145940. 1	−1555. 1	1. 21 1. 04
$5s^2\,5p^4(^3P)6d$	$6d\ ^2P$	1½ 0½	 145222. 7		 0. 38
$5s^2\,5p^4(^1D)7s$	$7s'\ ^2D$	2½ 1½	146305. 4 149802. 4	−3497. 0	1. 30
	14	2½	146927. 8		0. 98
	25°	1½	*147518. 0*		
	27°	2½	*147544. 6*		
	29°	1½	*147568. 6*		
$5s^2\,5p^4(^1D)6d'$	$6d'\ ^2D$	1½ 2½	148085. 2 149697. 3	1612. 1	1. 07
	31°	1½	*148374. 9*		
	33°	1½	*148952. 4*		
	35°	2½	*149281. 0*		
	37°	2½	*149682. 7*		
$5s^2\,5p^4(^1D)6d$	$6d'\ ^2F$	3½ 2½	 154032. 3		
	39°	1½	*156302. 9*		
	41°	1½	*157222. 1*		
Xe III($^3P_2$)	*Limit*	----	*171068. 4*		

January 1954.

Xe II Observed Terms *

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}+$	Observed Terms	
$5s^2\ 5p^5$	$5p^5\ ^2P^\circ$	
$5s\ 5p^6$	$5p^6\ ^2S$	
	$ns\ (n \geq 6)$	$np\ (n \geq 6)$
$5s^2\ 5p^4(^3P)nx$	$6, 7s\ ^4P$ $6, 7s\ ^2P$	$6p\ ^4S^\circ$ $6p\ ^4P^\circ$ $6p\ ^4D^\circ$ $6p\ ^2S^\circ$ $6p\ ^2P^\circ$ $6p\ ^2D^\circ$
$5s^2\ 5p^4(^1D)nx'$	$6, 7s'\ ^2D$	$6p'\ ^2P^\circ$ $6p'\ ^2D^\circ$ $6p'\ ^2F^\circ$
$5s^2\ 5p^4(^1S)nx''$	$6s''\ ^2S$	$6p''\ ^2P^\circ$
	$nd\ (n \geq 5)$	$nf\ (n \geq 4)$
$5s^2\ 5p^4(^3P)nx$	$5, 6d\ ^4P$ $5, 6d\ ^4D$ $5, 6d\ ^4F$ $5, 6d\ ^2P$ $5, 6d\ ^2D$	
$5s^2\ 5p^4(^1D)nx'$	$5d'\ ^2S$ $5d'\ ^2P$ $5, 6d'\ ^2D$ $5, 6d'\ ^2F$	$4f'\ ^2F^\circ$ $4f'\ ^2G^\circ$
$5s^2\ 5p^4(^1S)nx''$	$5d''\ ^2D$	

* For predicted terms in the spectra of the I I isoelectronic sequence, see Vol. III, Introduction.

Xe III

(Te I sequence; 52 electrons) $Z=54$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 5s^2\ 5p^4\ ^3P_2$

$5p^4\ ^3P_2$ 259089 K I. P. 32.1 volts

The terms are from the 1936 paper by Humphreys, with the revisions introduced by Humphreys, Meggers, and de Bruin from a study of the Zeeman effect, reported in 1939. Humphreys lists nearly 300 classified lines between 2235.35 A and 7653.8 A. Boyce has observed the Xe III spectrum in the extreme ultraviolet, and in collaboration with Humphreys has classified 128 lines between 627.393 A and 1978.702 A. "The most intense lines of the (^{4}S) family have been classified by de Bruin". Excepting one level, $6d\ ^5D^\circ_0$, the terms found by de Bruin are incorporated in the present analysis.

Observed intersystem combinations connect the singlet and triplet systems of terms.

"The absolute term values are arrived at from an estimation of the limit of the $5s^2\ 5p^3(^4S)nd\ ^5D^\circ$ series", ($n=5, 6$).

Edlén has classified two lines whose wave numbers agree with the ground-level separations of terms from $5s^2\ 5p^4$, giving the following intervals:

$$5p^4\ ^3P_2 - 5p^4\ ^3P_1 = 9794.6 \text{ K}$$

$$5p^4\ ^3P_2 - 5p^4\ ^1D_2 = 17098.97 \text{ K}.$$

He attributes these forbidden lines to magnetic-dipole transitions. His value of the interval $^3P_2 - ^3P_1$ is quoted in the table.

For miscellaneous levels the designated published numbers have been retained in column two, with the running electron added. The last six levels have "nx" substituted for the running electron, since it is not known whether this electron is $6d$ or $7s$.

Xe III—Continued

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Xe III

Config.	Desig.	J	Level	Interval	Obs. g
$5s^2 5p^4$	$5p^4$ ^3P	2	0	−9794.6	
		1	9795	1664	
		0	8131		
$5s^2 5p^4$	$5p^4$ ^1D	2	17100		
$5s^2 5p^4$	$5p^4$ ^1S	0	37398		
$5s 5p^5$	$5p^5$ $^3P^\circ$	2	*98263*	−5306	
		1	*103569*	−5890	
		0	*109459*		
$5s^2 5p^3(^4S^\circ)5d$	$5d$ $^5D^\circ$	4			
		3	*111605.46*	−250.88	
		2	*111856.34*	−593.51	
		1	*112449.85*	−244.01	
		0	*112693.86*		
$5s 5p^5$	$5p^5$ $^1P^\circ$	1	*119026.28*		
$5s^2 5p^3(^4S^\circ)5d$	$5d$ $^3D^\circ$	3	*121229.85*	−3461.87	
		2	*124691.72*	2768.69	
		1	*121923.03*		
$5s^2 5p^3(^4S^\circ)6s$	$6s$ $^5S^\circ$	2	*121476.00*		1.95
$5s^2 5p^3(^4S^\circ)6s$	$6s$ $^3S^\circ$	1	*125617.20*		1.77
$5s^2 5p^3(^2D^\circ)5d$	$5d'$ $^3F^\circ$	4			
		3	*126120.07*	−2229.44	
		2	*128349.51*		
$5s^2 5p^3(^2D^\circ)5d$	$5d'$ $^1F^\circ$	3	*127782.29*		
$5s^2 5p^3(^2D^\circ)5d$	$5d'$ $^3G^\circ$	3	*130174.00*	1986.06	
		4	*132160.06*		
		5			
$5s^2 5p^3(^2D^\circ)5d$	$5d'$ $^1G^\circ$	4	*132438.59*		
$5s^2 5p^3(^2D^\circ)6s$	$6s'$ $^3D^\circ$	1	*133234.28*	1433.21	0.38
		2	*134667.49*	3990.79	1.18
		3	*138658.28*		1.33
$5s^2 5p^3(^2D^\circ)5d$	$5d'$ 41°	2	*136367.65*		0.90
$5s^2 5p^3(^2D^\circ)5d$	$5d'$ $^3D^\circ$	1	*138145.61*	3918.88	0.50
		2	*142064.49*	1092.05	1.12
		3	*143156.54*		1.22
$5s^2 5p^3(^2D^\circ)5d$	$5d'$ $^3S^\circ$	1	*140731.23*		1.56
$5s^2 5p^3(^2D^\circ)6s$	$6s'$ $^1D^\circ$	2	*143048.37*		0.96
$5s^2 5p^3(^2D^\circ)5d$	$5d'$ $^1D^\circ$	2	*145300.39*		0.81
$5s^2 5p^3(^4S^\circ)6p$	$6p$ ^5P	1	146781.71	180.89	2.28
		2	146962.60	2099.00	1.70
		3	149061.60		1.57
$5s^2 5p^3(^2P^\circ)5d$	$5d''$ 13°	1	*147797.64*		
$5s^2 5p^3(^2P^\circ)5d$	$5d''$ 15°	2	*148370.28*		
$5s^2 5p^3(^2P^\circ)5d$	$5d''$ 17°	3	*148413.09*		
$5s^2 5p^3(^4S^\circ)6p$	$6p$ ^3P	0	152808.36	−2507.07	0.00
		1	150301.29	1756.65	1.56
		2	152057.94		1.50
$5s^2 5p^3(^2P^\circ)5d$	$5d''$ 19°	2	*150404.68*		
$5s^2 5p^3(^2P^\circ)6s$	$6s''$ $^3P^\circ$	0	*150505.45*	977.15	0.00
		1	*151482.60*	2410.81	1.47
		2	*153893.41*		
$5s^2 5p^3(^2P^\circ)6s$	$6s''$ $^1P^\circ$	1	*154639.61*		
$5s^2 5p^3(^2P^\circ)5d$	$5d''$ 23°	2	*158928.29*		

Xe III—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$5s^2\,5p^3(^2D^\circ)6p$	$6p'$ ^3D	1 2 3	158997.10 162260.10 166374.22	3263.00 4114.12	 1.17 1.22
$5s^2\,5p^3(^2P^\circ)5d$	$5d''$ 25°	1	*159388.29*		
$5s^2\,5p^3(^2D^\circ)6p$	$6p'$ ^3F	2 3 4	160691.50 162594.93 166554.95	1903.43 3960.02	0.84 1.08 1.28
$5s^2\,5p^3(^2P^\circ)5d$	$5d''$ 27°	2	*161810.39*		
$5s^2\,5p^3(^2D^\circ)6p$	$6p'$ ^1F	3	164438.80		1.09
$5s^2\,5p^3(^2D^\circ)6p$	$6p'$ 4	1	164511.82		0.42
$5s^2\,5p^3(^2D^\circ)6p$	$6p'$ ^3P	0 1 2	166295.67 168086.15 166880.21	1790.48 −1205.94	 1.30 1.38
$5s^2\,5p^3(^2D^\circ)4f'$?	$4f'$ 6	4	166355.52		1.31
$5s^2\,5p^3(^2D^\circ)6p$	$6p'$ ^1D	2	171990.00		1.08
$5s^2\,5p^3(^2P^\circ)6p$	$6p''$ ^3D	3 2 1	173946.80 177956.07 175231.35	−4009.27 2724.72	 1.18 0.65
$5s^2\,5p^3(^2P^\circ)6p$	$6p''$ 26	1	178029.58		1.51
$5s^2\,5p^3(^4S^\circ)6d$	$6d$ $^5D^\circ$	4 3 2 1 0	*182122.97* *182464.24* *182482.75* *182551.13* *182840.79*	−341.27 −18.51 −68.38 −289.66	

Xe III—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$5s^2\,5p^3(^2P^\circ)6p$	$6p''$ 28	1	182134.41		
$5s^2\,5p^3(^4S^\circ)7s$	$7s$ $^5S^\circ$	2	*182337.31*		
$5s^2\,5p^3(^2P^\circ)6p$	$6p''$ ^3P	2 1 0	 183220.15		
$5s^2\,5p^3(^2P^\circ)6p$	$6p''$ 32	1	184009.37		
$5s^2\,5p^3(^2P^\circ)6p$	$6p''$ 34	1	184570.60		
$5s^2\,5p^3(^2P^\circ)6p$	$6p''$ 36	1 or 2	185888.20		
$5s^2\,5p^3(^4S^\circ)7s$	$7s$ $^3S^\circ$	1	*188023.28*		
$5s^2\,5p^3(^2D^\circ)nx$	nx' 29°	2	*195897.58*		
"	nx' 31°	2	*195977.30*		
"	nx' 33°	2 or 3	*196261.30*		
"	nx' 35°	2 or 3	*196537.90*		
"	nx' 37°	2 or 3	*196608.67*		
"	nx' 39°	3	*200050.37*		
Xe IV ($^4S_{1\frac{1}{2}}$)	*Limit*	------	259089		

October 1953.

Xe III Observed Terms*

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6$ $3d^{10}\,4s^2\,4p^6\,4d^{10}+$	Observed Terms		
$5s^2\,5p^4$	$5p^4$ ^1S $5p^4$ ^3P $5p^4$ ^1D		
$5s\,5p^5$	$5p^5$ $^3P^\circ$ $5p^5$ $^1P^\circ$		
	ns $(n \geq 6)$	np $(n \geq 6)$	nd $(n \geq 5)$
$5s^2\,5p^3(^4S^\circ)nx$	6, 7s $^5S^\circ$ 6, 7s $^3S^\circ$	$6p$ ^5P $6p$ ^3P	5, 6d $^5D^\circ$ $5d$ $^3D^\circ$
$5s^2\,5p^3(^2D^\circ)nx'$	$6s'$ $^3D^\circ$ $6s'$ $^1D^\circ$	$6p'$ ^3P $6p'$ ^3D $6p'$ ^3F $6p'$ ^1D $6p'$ ^1F	$5d'$ $^3S^\circ$ $5d'$ $^3D^\circ$ $5d'$ $^3F^\circ$ $5d'$ $^3G^\circ$ $5d'$ $^1D^\circ$ $5d'$ $^1F^\circ$ $5d'$ $^1G^\circ$
$5s^2\,5p^3(^2P^\circ)nx''$	$6s''$ $^3P^\circ$ $6s''$ $^1P^\circ$	$6p''$ ^3P $6p''$ ^3D	

*For predicted terms in the spectra of the Te I isoelectronic sequence, see Vol. III, Introduction.

Xe IV

(Sb I sequence; 51 electrons) $Z=54$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 5s^2\ 5p^3\ {}^4S^\circ_{1\frac{1}{2}}$

$5p^3\ {}^4S^\circ_{1\frac{1}{2}}$ K I. P. volts

The analysis is by Humphreys, who has furnished the data in the table in advance of publication. His work is based on observations made by Boyce. There are 83 classified lines in the interval 558 A to 1249 A.

Further observations are needed to extend the analysis. In cases where the observed combinations do not determine the J-value, the two possible choices are indicated in column three. No series are known in this spectrum.

REFERENCES

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Xe IV

Config.	Desig.	J	Level	Interval
$5s^2\ 5p^3$	$5p^3\ {}^4S^\circ$	1½	0	
$5s^2\ 5p^3$	$5p^3\ {}^2D^\circ$	1½	*13268*	4244
		2½	*17512*	
$5s^2\ 5p^3$	$5p^3\ {}^2P^\circ$	0½	*28036?*	13847
		1½	*41883?*	
		1½, 2½	99664	
		1½, 2½	106924	
		0½	109255	
		1½	121929	
		1½, 2½	125475	
		1½	133027	
		1½, 2½	134981	
		1½, 2½	136495	
		1½	145107	
		1½, 2½	146205	
		1½, 2½	148684	

Xe IV

Config.	Desig.	J	Level	Interval
		0½	154532	
		0½	157205?	
		0½	158610	
		1½, 2½	159643	
		0½	161435	
		1½	163596	
		0½	165281?	
		1½	165995	
		0½	167208	
		1½, 2½	170132	
		1½, 2½	170491	
		1½	173221	
		1½, 2½	176043	
		1½, 2½	179001	
		1½, 2½	186052	

January 1956.

CESIUM

Cs I

55 electrons $Z=55$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,5s^2\,5p^6\,6s\ {}^2S_{1/2}$

$6s\ {}^2S_{1/2}$ 31406.71 K I. P. 3.893 volts

A number of references have been used to derive the best available level values from the separate sets of wavelength measurements, starting with the ground state zero. For the principal series and the limit quoted above, the results of Kratz are quoted. He has observed this series in absorption to $n=73$. McNally and his associates have also carried the observations of this series in absorption to $n=62$, and give the limit as 31406.32 K. For the ${}^2D$ series Mack has furnished his unpublished observations of the forbidden lines $6s\ {}^2S-nd\ {}^2D(n=9$ to $21)$, for inclusion here. The work of Meissner and Weinmann has provided data for some ${}^2D$, ${}^2S$ terms and for the ${}^2F^\circ$ series. Meggers' observations furnish revised values for $6p\ {}^2P^\circ$ and $6d\ {}^2D$.

The well-known series from Fowler and Paschen-Götze are given by Bacher and Goudsmit. Their terms that still need to be re-evaluated from more accurate observations have been rounded off in the table, namely, 11, $12s\ {}^2S$; 5, $6g\ {}^2G$; and $6h\ {}^2H^\circ$. New measurements in the near infrared furnished by Fisher in advance of publication, give the connection of the $5d\ {}^2D$ and $nf\ {}^2F^\circ$ terms with the rest of the terms, and the quoted value of $7s\ {}^2S$.

Beutler and Guggenheimer have classified 53 ultraviolet lines observed in absorption, between 653.60 A and 1007.5 A, as transitions from the ground term to levels above the ionisation limit. The high limits are from the Cs II analysis. These authors have classified four groups of lines called A, B, C, D, having the respective limits in Cs II ${}^3P^\circ_2$, ${}^3P^\circ_1$, ${}^3P^\circ_0$, and ${}^1P^\circ_1$. The value of the limit they use for group C (${}^3P^\circ_0$), 150870K, has since been replaced in Cs II by one at 153772 K. The writer has, therefore, attempted to adjust the series for group C by assuming that their first series members $5d$ and $7s$ are correct as given, and adopting the best available lines that fit the revised limit. Consequently, their level at 142577 K is now labeled $6d$? instead of $8s$; their level at 139694 K, formerly called $6d$, has been rejected; and the $8s$ level is tentatively placed at 144501 K. The miscellaneous levels, which are the wave numbers of the observed ultraviolet lines, have been assigned numbers by the writer. The double entries of J for these levels (unlike those for unresolved terms) indicate that the existing data are insufficient to determine which value of J is correct.

The ground state $6s\ {}^2S_{1/2}$ has a hyperfine structure with a separation of about 0.30 K observed by Kratz from 7 to $72p\ {}^2P^\circ$. Mack has also observed it in the $6s\ {}^2S-nd\ {}^2D$ observations from $n=9$ to 15.

More than 200 lines are classified between 653.60 A and 7.4 μ.

Cs I—Continued

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Cs I

Config.	Desig.	J	Level	Interval
$5p^6(^1S)6s$	$6s\ ^2S$	½	0.00	
$5p^6(^1S)6p$	$6p\ ^2P^\circ$	½ 1½	*11178.24* *11732.35*	554.11
S)$5d$	$5d\ ^2D$	1½ 2½	14499.490 14597.08	97.59
$5p^6(^1S)7s$	$7s\ ^2S$	½	18535.51	
$5p^6(^1S)7p$	$7p\ ^2P^\circ$	½ 1½	*21765.65* *21946.66*	181.01
$5p^6(^1S)6d$	$6d\ ^2D$	1½ 2½	22588.89 22631.83	42.94
$5p^6(^1S)8s$	$8s\ ^2S$	½	24317.17	
$5p^6(^1S)4f$	$4f\ ^2F^\circ$	3½ 2½	*24472.287* *24472.463*	−0.176
$5p^6(^1S)8p$	$8p\ ^2P^\circ$	½ 1½	*25709.14* *25791.78*	82.64
$5p^6(^1S)7d$	$7d\ ^2D$	1½ 2½	26047.86 26068.83	20.97
$5p^6(^1S)9s$	$9s\ ^2S$	½	26910.68	
$5p^6(^1S)5f$	$5f\ ^2F^\circ$	3½ 2½	*26971.415* *26971.562*	−0.147
$5p^6(^1S)5g$	$5g\ ^2G$	3½, 4½	27010	
$5p^6(^1S)9p$	$9p\ ^2P^\circ$	½ 1½	*27637.29* *27681.96*	44.67
$5p^6(^1S)8d$	$8d\ ^2D$	1½ 2½	27811.25 27822.94	11.69

Cs I

Config.	Desig.	J	Level	Interval
$5p^6(^1S)10s$	$10s\ ^2S$	½	28300.28	
$5p^6(^1S)6f$	$6f\ ^2F^\circ$	3½ 2½	*28329.660* *28329.762*	−0.102
$5p^6(^1S)6g$	$6g\ ^2G$	3½, 4½	28347	
$5p^6(^1S)6h$	$6h\ ^2H^\circ$	4½, 5½	*28356*	
$5p^6(^1S)10p$	$10p\ ^2P^\circ$	½ 1½	*28727.09* *28753.93*	26.84
$5p^6(^1S)9d$	$9d\ ^2D$	1½ 2½	28828.90 28836.06	7.16
$5p^6(^1S)11s$	$11s\ ^2S$	½	29130	
$5p^6(^1S)7f$	$7f\ ^2F^\circ$	3½ 2½	*2[illegible].156* *29148.225*	−0.069
$5p^6(^1S)11p$	$11p\ ^2P^\circ$	½ 1½	*29403.68* *29421.10*	17.42
$5p^6(^1S)10d$	$10d\ ^2D$	1½ 2½	29468.54 29473.22	4.68
$5p^6(^1S)12s$	$12s\ ^2S$	½	29666	
$5p^6(^1S)8f$	$8f\ ^2F^\circ$	3½ 2½	*29678.935* *29678.979*	−0.044
$5p^6(^1S)12p$	$12p\ ^2P^\circ$	½ 1½	*29852.85* *29864.72*	11.87
$5p^6(^1S)11d$	$11d\ ^2D$	1½ 2½	29896.64 29899.89	3.25
$5p^6(^1S)9f$	$9f\ ^2F^\circ$	3½ 2½	*30042.515* *30042.540*	−0.025

Cs I—Continued

Config.	Desig.	J	Level	Interval
$5p^6(^1S)13p$	$13p\ ^2P^\circ$	0½ 1½	30166.00 30174.51	8.51
$5p^6(^1S)12d$	$12d\ ^2D$	1½ 2½	30197.02 30199.35	2.33
$5p^6(^1S)10f$	$10f\ ^2F^\circ$	3½ 2½	30302.383 30302.390	−0.007
$5p^6(^1S)14p$	$14p\ ^2P^\circ$	0½ 1½	30393.16 30399.49	6.33
$5p^6(^1S)13d$	$13d\ ^2D$	1½ 2½	30416.06 30417.76	1.70
$5p^6(^1S)11f$	$11f\ ^2F^\circ$	3½, 2½	30494.59	
$5p^6(^1S)15p$	$15p\ ^2P^\circ$	0½ 1½	30563.27 30567.98	4.71
$5p^6(^1S)14d$	$14d\ ^2D$	1½ 2½	30580.46 30581.79	1.33
$5p^6(^1S)12f$	$12f\ ^2F^\circ$	3½, 2½	30640.93	
$5p^6(^1S)16p$	$16p\ ^2P^\circ$	0½ 1½	30693.76 30697.52	3.76
$5p^6(^1S)15d$	$15d\ ^2D$	1½ 2½	30707.11 30707.96	0.85
$5p^6(^1S)17p$	$17p\ ^2P^\circ$	0½ 1½	30796.20 30799.15	2.95
$5p^6(^1S)16d$	$16d\ ^2D$	1½ 2½	30806.59 30807.2	0.6
$5p^6(^1S)18p$	$18p\ ^2P^\circ$	0½ 1½	30878.07 30880.41	2.34
$5p^6(^1S)17d$	$17d\ ^2D$	1½, 2½	30886.7	
$5p^6(^1S)19p$	$19p\ ^2P^\circ$	0½ 1½	30944.49 30946.43	1.94
$5p^6(^1S)18d$	$18d\ ^2D$	1½, 2½	30951.5	
$5p^6(^1S)20p$	$20p\ ^2P^\circ$	0½ 1½	30999.15 31000.74	1.59
$5p^6(^1S)19d$	$19d\ ^2D$	1½, 2½	31005.0	
$5p^6(^1S)21p$	$21p\ ^2P^\circ$	0½ 1½	31044.63 31046.00	1.37
$5p^6(^1S)20d$	$20d\ ^2D$	1½, 2½	31049.5	
$5p^6(^1S)22p$	$22p\ ^2P^\circ$	0½, 1½	31084.08	
$5p^6(^1S)21d$	$21d\ ^2D$	1½, 2½	31086.7	
$5p^6(^1S)23p$	$23p\ ^2P^\circ$	0½, 1½	31116.40	

Cs I—Continued

Config.	Desig.	J	Level	Interval
$5p^6(^1S)24p$	$24p\ ^2P^\circ$	0½, 1½	31144.13	
$5p^6(^1S)25p$	$25p\ ^2P^\circ$	0½, 1½	31168.04	
$5p^6(^1S)26p$	$26p\ ^2P^\circ$	0½, 1½	31188.87	
$5p^6(^1S)27p$	$27p\ ^2P^\circ$	0½, 1½	31207.07	
$5p^6(^1S)28p$	$28p\ ^2P^\circ$	0½, 1½	31223.09	
$5p^6(^1S)29p$	$29p\ ^2P^\circ$	0½, 1½	31237.24	
$5p^6(^1S)30p$	$30p\ ^2P^\circ$	0½, 1½	31249.81	
$5p^6(^1S)31p$	$31p\ ^2P^\circ$	0½, 1½	31261.05	
$5p^6(^1S)32p$	$32p\ ^2P^\circ$	0½, 1½	31271.13	
$5p^6(^1S)33p$	$33p\ ^2P^\circ$	0½, 1½	31280.17	
$5p^6(^1S)34p$	$34p\ ^2P^\circ$	0½, 1½	31288.36	
$5p^6(^1S)35p$	$35p\ ^2P^\circ$	0½, 1½	31295.76	
$5p^6(^1S)36p$	$36p\ ^2P^\circ$	0½, 1½	31302.51	
$5p^6(^1S)37p$	$37p\ ^2P^\circ$	0½, 1½	31308.61	
$5p^6(^1S)38p$	$38p\ ^2P^\circ$	0½, 1½	31314.21	
$5p^6(^1S)39p$	$39p\ ^2P^\circ$	0½, 1½	31319.39	
$5p^6(^1S)40p$	$40p\ ^2P^\circ$	0½, 1½	31324.11	
$5p^6(^1S)41p$	$41p\ ^2P^\circ$	0½, 1½	31328.47	
$5p^6(^1S)42p$	$42p\ ^2P^\circ$	0½, 1½	31332.47	
$5p^6(^1S)43p$	$43p\ ^2P^\circ$	0½, 1½	31336.19	
$5p^6(^1S)44p$	$44p\ ^2P^\circ$	0½, 1½	31339.67	
$5p^6(^1S)45p$	$45p\ ^2P^\circ$	0½, 1½	31342.84	
$5p^6(^1S)46p$	$46p\ ^2P^\circ$	0½, 1½	31345.80	
$5p^6(^1S)47p$	$47p\ ^2P^\circ$	0½, 1½	31348.58	
$5p^6(^1S)48p$	$48p\ ^2P^\circ$	0½, 1½	31351.18	
$5p^6(^1S)49p$	$49p\ ^2P^\circ$	0½, 1½	31353.57	
$5p^6(^1S)50p$	$50p\ ^2P^\circ$	0½, 1½	31355.85	
$5p^6(^1S)51p$	$51p\ ^2P^\circ$	0½, 1½	31357.96	
$5p^6(^1S)52p$	$52p\ ^2P^\circ$	0½, 1½	31359.95	
$5p^6(^1S)53p$	$53p\ ^2P^\circ$	0½, 1½	31361.80	

Cs I—Continued

Config.	Desig.	J	Level	Interval
$5p^6(^1S)54p$	$54p\ ^2P^\circ$	0½, 1½	*31363.60*	
$5p^6(^1S)55p$	$55p\ ^2P^\circ$	0½, 1½	*31365.23*	
$5p^6(^1S)56p$	$56p\ ^2P^\circ$	0½, 1½	*31366.78*	
$5p^6(^1S)57p$	$57p\ ^2P^\circ$	0½, 1½	*31368.31*	
$5p^6(^1S)58p$	$58p\ ^2P^\circ$	0½, 1½	*31369.69*	
$5p^6(^1S)59p$	$59p\ ^2P^\circ$	0½, 1½	*31370.96*	
$5p^6(^1S)60p$	$60p\ ^2P^\circ$	0½, 1½	*31372.26*	
$5p^6(^1S)61p$	$61p\ ^2P^\circ$	0½, 1½	*31373.43*	
$5p^6(^1S)62p$	$62p\ ^2P^\circ$	0½, 1½	*31374.56*	
$5p^6(^1S)63p$	$63p\ ^2P^\circ$	0½, 1½	*31375.62*	
$5p^6(^1S)64p$	$64p\ ^2P^\circ$	0½, 1½	*31376.62*	
$5p^6(^1S)65p$	$65p\ ^2P^\circ$	0½, 1½	*31377.59*	
$5p^6(^1S)66p$	$66p\ ^2P^\circ$	0½, 1½	*31378.56*	
$5p^6(^1S)67p$	$67p\ ^2P^\circ$	0½, 1½	*31379.46*	
$5p^6(^1S)68p$	$68p\ ^2P^\circ$	0½, 1½	*31380.29*	
$5p^6(^1S)69p$	$69p\ ^2P^\circ$	0½, 1½	*31381.08*	
$5p^6(^1S)70p$	$70p\ ^2P^\circ$	0½, 1½	*31381.87*	
$5p^6(^1S)71p$	$71p\ ^2P^\circ$	0½, 1½	*31382.67*	
$5p^6(^1S)72p$	$72p\ ^2P^\circ$	0½, 1½	*31383.28*	
$5p^6(^1S)73p$	$73p\ ^2P^\circ$	0½, 1½	*31383.65*	
Cs II ($^1S_0$)	*Limit*	-------	**31406.71**	
$5p^5(^2P_{1½})6s^2$ $5p^5(^2P_{0½})6s^2$	$6s^2\ ^2P^\circ$	1½ 0½	*99259* *109069*	−9810
$5p^5\ 6s(^3P_2)5d$	$5d$ 1°	1½	*113491*	
$5p^5\ 6s(^3P_1)5d$	$5d$ 2°	0½	*114560*	
$5p^5\ 6s(^3P_2)5d$	$5d$ 3°	0½	*117539*	
$5p^5\ 6s(^3P_1)5d$	$5d$ 4°	1½	*117707*	
$5p^5\ 6s(^3P_2)5d$	$5d$ 5°	1½	*118574*	
$5p^5\ 6s(^3P_2)5d$	$5d$ 6°	0½	*122653*	
$5p^5\ 6s(^3P_1)7s$ $5p^5\ 6s(^3P_1)7s$	$7s\ ^2P^\circ$	1½ 0½	*123498* *124205*	*−707*
$5p^5\ 6s(^3P_1)5d$	$5d$ 7°	1½	*124804*	
$5p^5\ 6s(^3P_1)7s$	$7s\ ^4P^\circ$	1½	*125096*	
$5p^5\ 6s(^3P_2)6d$	$6d$ 8°	0½, 1½	*126203*	
$5p^5\ 6s(^3P_1)6d$	$6d$ 9°	0½, 1½	*126488*	
$5p^5\ 6s(^3P_2)6d$	$6d$ 10°	0½, 1½	*127426*	
$5p^5\ 6s(^3P_1)6d$	$6d$ 11°	0½, 1½	*127868*	
$5p^5\ 6s(^3P_2)6d$	$6d$ 12°	0½, 1½	*127973*	
$5p^5\ 6s(^3P_2)5d$	$5d'\ ^4F^\circ$	1½	*130329*	
$5p^5\ 6s(^1P_1)5d$	$5d'\ ^2F^\circ$	1½	*130527*	
$5p^5\ 6s(^3P_1)8s$	$8s\ ^2P^\circ$	0½	*131211*	
$5p^5\ 6s(^3P_1)6d$	$6d$ 13°	0½, 1½	*131256*	
$5p^5\ 6s(^3P_1)8s$	$8s\ ^4P^\circ$	1½	*131504*	
$5p^5\ 6s(^3P_2)7d$	$7d$ 14°	0½, 1½	*131826*	
$5p^5\ 6s(^3P_2)7d$	$7d$ 15°	0½, 1½	*132550*	
$5p^5\ 6s(^3P_1)7d$	$7d$ 16°	0½, 1½	*132706*	
$5p^5\ 6s(^3P_2)9s$?	$9s\ ^2P^\circ$	1½	*133564*	
$5p^5\ 6s(^1P_1)5d$	$5d'$ 17°	1½	*133906*	
$5p^5\ 6s(^1P_1)5d$	$5d'$ 18°	0½	*134212*	
$5p^5\ 6s(^3P_2)8d$ $5p^5\ 6s(^3P_1)9s$?	$8d$ 19° $9s$ 20°	} 0½, 1½	*134614*	
$5p^5\ 6s(^3P_1)8d$	$8d$ 21°	0½, 1½	*135014*	
$5p^5\ 6s(^3P_2)7s$	$7s'\ ^4P^\circ$	0½	*135164*	
$5p^5\ 6s(^3P_2)10s$	$10s\ ^2P^\circ$	1½?	*135322*	
$5p^5\ 6s(^3P_2)12s$? $5p^5\ 6s(^3P_1)11s$?	$12s\ ^2P^\circ$ $11s$ 22°	1½ 0½, 1½	} *136855*	
$5p^5\ 6s(^3P_2)13s$	$13s\ ^2P^\circ$	1½	*137297*	
$5p^5\ 6s(^3P_1)12s$?	$12s$ 23°	0½, 1½	*137541*	
$5p^5\ 6s(^1P_1)7s$	$7s'\ ^2P^\circ$	0½ 1½	*137794* *138803*	1009
Cs II ($^3P_2$)	*Limit*	-------	*138799*	

Cs I—Continued

Config.	Desig.	J	Level	Interval
Cs II($^3P_2$)	*Limit*	--------	*139318*	
$5p^5\,6s(^3P_2)6d$?	$6d'$ $^4P^°$	$0\frac{1}{2}$	} *142577*	
$5p^5\,6s(^1P_1)6d$	$6d'$ $24^°$	$0\frac{1}{2}$, $1\frac{1}{2}$		
$5p^5\,6s(^1P_1)6d$	$6d'$ $25^°$	$0\frac{1}{2}$, $1\frac{1}{2}$	*143691*	
$5p^5\,6s(^1P_1)6d$	$6d'$ $26^°$	$0\frac{1}{2}$, $1\frac{1}{2}$	*143877*	
$5p^5\,6s(^3P_2)8s$?	$8s'$ $^4P^°$	$0\frac{1}{2}$	*144501*	
$5p^5\,6s(^1P_1)8s$	$8s'$ $^2P^°$	$0\frac{1}{2}$?	*146308*	
$5p^5\,6s(^1P_1)7d$	$7d'$ $27^°$	$0\frac{1}{2}$, $1\frac{1}{2}$	*147628*	
$5p^5\,6s(^1P_1)7d$	$7d'$ $28^°$	$0\frac{1}{2}$, $1\frac{1}{2}$	*147994*	
$5p^5\,6s(^1P_1)7d$	$7d'$ $29^°$	$0\frac{1}{2}$, $1\frac{1}{2}$	*148283*	

Cs I—Continued

Config.	Desig.	J	Level	Interval
$5p^5\,6s(^1P_1)9s$	$9s'$ $^2P^°$	$0\frac{1}{2}$	*149596*	
$5p^5\,6s(^1P_1)8d$	$8d'$ $30^°$	$0\frac{1}{2}$, $1\frac{1}{2}$	*150404*	
$5p^5\,6s(^1P_1)9d$	$9d'$ $31^°$	$0\frac{1}{2}$, $1\frac{1}{2}$	*151551*	
$5p^5\,6s(^1P_1)9d$	$9d'$ $32^°$	$0\frac{1}{2}$, $1\frac{1}{2}$	*151744*	
$5p^5\,6s(^1P_1)11s$	$11s'$ $^2P^°$	$0\frac{1}{2}$	*151925*	
$5p^5\,6s(^1P_1)10d$	$10d'$ $33^°$	$0\frac{1}{2}$, $1\frac{1}{2}$	*152368*	
$5p^5\,6s(^1P_1)11d$	$11d'$ $34^°$	$0\frac{1}{2}$, $1\frac{1}{2}$	*152722*	
$5p^5\,6s(^1P_1)12d$?	$12d'$ $35^°$	$0\frac{1}{2}$, $1\frac{1}{2}$	*152999*	
Cs II($^3P_2$)	*Limit*	--------	*153772*	
Cs II($^1P_1$)	*Limit*	--------	*154873*	

February 1955.

Cs II

(Xe I sequence; 54 electrons) $Z=55$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,5s^2\,5p^6\ {}^1S_0$

$5p^6\ {}^1S_0$ **202263 K** I. P. 25.1 volts

The analysis of Cs II was started by Sommer in 1924 and has since been revised and extended by Sawyer and his associates. There are nearly 350 classified lines, and the observations extend from 564.25 A to 6955.519 A.

The levels listed in the table are from the 1942 paper, which contains an array of the observed combinations. From the descriptions of the lines given in the various papers, including that in the 1942 paper on "The Hyperfine Structure of Cs II", and, by analogy with Xe I, the writer has tentatively assigned the Jl-coupling notation to levels from the 6, 7s, 5,6d, and 6,7p configurations. These assignments need further confirmation and are far from definitive. Trees has pointed out that configuration-interaction is prominent in this spectrum; consequently, further assignments of the pair-coupling notation are very difficult. The numbers used by Wheatley and Sawyer to label the many levels have, therefore, been retained in column 1 of the table.

The limit is from Boyd and Sawyer, who derived it by means of a Rydberg formula from the two-member series $5p^6\ {}^1S_0 - ns'[0\frac{1}{2}]_1^°$, $n=6,7$. The higher member of the limit term has been obtained by adding the interval of the ground term of Cs III, 13884 K, to the limit quoted above.

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Cs II

Authors	Config.	Desig.	J	Level	Interval
	$5p^6$	$5p^6\ ^1S$	0	0.00	
3_2°	$5p^5(^2P^{\circ}_{1\frac{1}{2}})6s$	$6s\ [1\frac{1}{2}]^{\circ}$	2	*107398.33*	
5_1°			1	*107906.01*	
13_0°	$5p^5(^2P^{\circ}_{0\frac{1}{2}})6s$	$6s'\ [0\frac{1}{2}]^{\circ}$	0	*122365.51*	
14_1°			1	*122866.03*	
4_0°	$5p^5(^2P^{\circ}_{1\frac{1}{2}})5d$	$5d\ [0\frac{1}{2}]^{\circ}$	0	*107563.14*	
2_1°			1	*106222.77*	
6_2°	"	$5d\ [1\frac{1}{2}]^{\circ}$	2	*108304.19*	
7_1°			1	*110945.18*	
8_4°	"	$5d\ [3\frac{1}{2}]^{\circ}$	4	*112236.53*	
1_3°			3	*105949.74*	
9_2°	"	$5d\ [2\frac{1}{2}]^{\circ}$	2	*112795.08*	
10_3°			3	*113716.61*	
11_2°	$5p^5(^2P^{\circ}_{0\frac{1}{2}})5d$	$5d'\ [1\frac{1}{2}]^{\circ}$	2	*119665.41*	
15_1°			1	*123636.44*	
12_2°	"	$5d'\ [2\frac{1}{2}]^{\circ}$	2	*120404.87*	
			3		
1_1	$5p^5(^2P^{\circ}_{1\frac{1}{2}})6p$	$6p\ [0\frac{1}{2}]$	1	126518.54	
2_2	"	$6p\ [2\frac{1}{2}]$	2	128089.83	
3_3			3	129107.65	
4_1	"	$6p\ [1\frac{1}{2}]$	1	129989.72	
5_2			2	130766.00	
6_0	"	$6p\ [0\frac{1}{2}]$	0	133153.54	
7_1	$5p^5(^2P^{\circ}_{0\frac{1}{2}})6p$	$6p'\ [1\frac{1}{2}]$	1	141555.59	
9_2			2	143394.19	
8_1	"	$6p'\ [0\frac{1}{2}]$	1	143352.12	
10_0			0	144523.45	
16_2°	$5p^5(^2P^{\circ}_{1\frac{1}{2}})7s$	$7s\ [1\frac{1}{2}]^{\circ}$	2	*149212.25*	
			1		
27_0°	$5p^5(^2P^{\circ}_{0\frac{1}{2}})7s$	$7s'\ [0\frac{1}{2}]^{\circ}$	0	*163024.80*	
28_1°			1	*163180.20*	
	$5p^5(^2P^{\circ}_{1\frac{1}{2}})6d$	$6d\ [0\frac{1}{2}]^{\circ}$	0		
17_1°			1	*149605.33*	
19_2°	"	$6d\ [1\frac{1}{2}]^{\circ}$	2	*152791.49*	
18_1°			1	*152172.11*	
	"	$6d\ [3\frac{1}{2}]^{\circ}$?	4		
22_3°			3	*153678.17*	
20_2°	"	$6d\ [2\frac{1}{2}]^{\circ}$?	2	*153308.27*	
21_3°			3	*153556.54*	
11_1	$5p^5(^2P^{\circ}_{1\frac{1}{2}})7p$	$7p\ [0\frac{1}{2}]$	1	155965.45	
12_2	"	$7p\ [2\frac{1}{2}]$	2	156115.18	
13_3			3	156513.16	
15_1	"	$7p\ [1\frac{1}{2}]$	1	157062.46	
14_2			2	156757.30	
16_0	"	$7p\ [0\frac{1}{2}]$	0	157743.28	
17_1	$5p^5(^2P^{\circ}_{0\frac{1}{2}})7p$	$7p'\ [1\frac{1}{2}]$	1	166096.39	
19_2			2	168525.71	
18_1	"	$7p'\ [0\frac{1}{2}]$	1	167453.71	
			0		

Cs II

Authors	Config.	Desig.	J	Level	Interval
23_1°			1	*156399.81*	
24_2°			2	*158717.91*	
25_0°			0	*162352.92*	
26_3°			3	*162388.96*	
29_2°			2	*164444.88*	
30_1°			1	*164466.70*	
31_1°	$5p^5(^2P^{\circ}_{1\frac{1}{2}})7d$,		1	*164656.77*	
32_1°	$5p^5(^2P^{\circ}_{1\frac{1}{2}})8s$,		1	*165813.70*	
33_1°	$5p^5(^2P^{\circ}_{0\frac{1}{2}})6d$		1	*165843.10*	
34_2°			2	*165890.08*	
35_3°			3	*166117.72*	
36_2°			2	*166131.11*	
37_3°			3	*166600.74*	
38_2°			2	*166687.09*	
39_2°			2	*166961.57*	
40_3°			3	*167015.97*	
41_1°			1	*167434.91*	
42_0°			0	*168721.56*	
43_1°			1	*169813.40*	
44_2°	$5p^5(^2P^{\circ}_{1\frac{1}{2}})8d$,		2	*169588.87*	
45_1°	$5p^5(^2P^{\circ}_{1\frac{1}{2}})9s$,		1	*170363.90*	
46_2°	$5p^5(^2P^{\circ}_{0\frac{1}{2}})7d$,		2	*170504.28*	
47_3°	$5p^5(^2P^{\circ}_{0\frac{1}{2}})8s$		3	*172544.21*	
48_3°			3	*172826.52*	
49_0°			0	*173244.21*	
50_1°			1	*173837.00*	
51_1°			1	*175951.42*	
	$5p^5(^2P^{\circ}_{1\frac{1}{2}})10s$	$10s\ [1\frac{1}{2}]^{\circ}$	2		
52_1°			1	*177243.50*	
27_2			2	188791.09	
26_2			2	191002.05	
25_3			3	191103.04	
24_2			2	192475.51	
23_3	$5p^5(^2P^{\circ}_{1\frac{1}{2}})nf$		3	192530.62	
21_1			1	192675.63	
22_3			3	197642.3	
20_3			3	200406.90	
	Cs III($^2P^{\circ}_{1\frac{1}{2}}$)	*Limit*		202263	
	Cs III($^2P^{\circ}_{0\frac{1}{2}}$)	*Limit*		216147	

Cs III

(I I sequence; 53 electrons) $Z=55$

Ground state $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10} 5s^2 5p^5\ ^2P^{\circ}_{1\frac{1}{2}}$

$5p^5\ ^2P^{\circ}_{1\frac{1}{2}}$ K I. P. volts

This spectrum needs further study. Fitzgerald and Sawyer have classified 17 lines between 529.7 A and 877.9 A as combinations of the ground term with higher energy levels. By analogy with Xe II the writer has labeled the third level in the table as $5p^6\ ^2S$. The remaining "even" levels are probably from the $5s^2 5p^4 5d$ and $5s^2 5p^4 6s$ configurations.

From a study of screening constants Finkelnburg and Humbach have extrapolated an ionization potential of 34.6±0.7 volts.

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Cs III

Config.	Desig.	J	Level	Interval
$5s^2 5p^5$	$5p^5\ ^2P^{\circ}$	$1\frac{1}{2}$	*0*	−13884
		$0\frac{1}{2}$	*13884*	
$5s\ 5p^6$	$5p^6\ ^2S$	$0\frac{1}{2}$	127786	
			136146	
			138453	
			145655	
			155040	
			167872	
			181758	
			182546	
			188794	

January 1955.

BARIUM

Ba I

56 electrons $Z=56$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,5s^2\,5p^6\,6s^2\;{}^1S_0$

$6s^2\;{}^1S_0$ 42032.4 K I. P. 5.210 volts

The Ba I spectrum, like those of Ca I and Sr I, has contributed an important share in the development of the theory of atomic spectra. Russell and Saunders in 1925 included Ba I in their discussion of terms involving two excited electrons in addition to the "regular" series. White discusses these terms further in his paper on "Auto-Ionization in the Alkaline Earth Metals and the Inert Gases."

The "regular" terms have been taken from Saunders, Paschen-Götze, and Fowler, with the revisions suggested by Shenstone and Russell in 1932. The limit is also from this later paper, which discusses in detail the perturbed series of Ba I. Whitelaw, Langstroth, and others have also investigated perturbations in this spectrum.

Sullivan and Burns have improved a number of the energy-level values from their accurate interferometric measurements of Ba I. With these as a start, the writer has prepared a line list and multiplet array, and revised the decimals of the remaining values for inclusion here. In the long-wave region she has utilized Meggers' 1933 data supplemented by his 1935 unpublished observations. Russell's unpublished material (1933) has also been placed at her disposal for this work. In this revised list there are approximately 390 classified lines between 2473 A and 30934 A. Observed intersystem combinations connect the singlet and triplet systems of terms.

The writer has derived the g-values in the table from the Zeeman observations given by B. E. Moore. The measurements published by Moore ($\Delta\lambda/\lambda^2$) have been divided by the factor 1.09 throughout, a correction factor adopted to reduce them to the theoretical Landé patterns for a few very well-known lines. For unresolved patterns the formulas for blends given by Shenstone and Blair, as discussed by Russell (1930), have been used.

A monograph on Ba I is needed. The existing data are not homogeneous, even though the spectrum is well analyzed. The complete analysis is given in the 1955 Bureau reference below.

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Ba I

Config.	Desig.	J	Level	Interval	Obs. g
$6s^2$	$6s^2\ ^1S$	0	0.00		
$6s(^2S)5d$	$5d\ ^3D$	1	9033.985	181.533	0.53
		2	9215.518	381.033	1.18
		3	9596.551		1.38
$6s(^2S)5d$	$5d\ ^1D$	2	11395.382		1.00
$6s(^2S)6p$	$6p\ ^3P^\circ$	0	*12266.021*	370.595	
		1	*12636.616*	878.122	1.45
		2	*13514.738*		1.52
$6s(^2S)6p$	$6p\ ^1P^\circ$	1	*18060.264*		1.02
$5d(^2D)6p$	$6p'\ ^3F^\circ$	2	*22064.661*	882.777	
		3	*22947.438*	809.639	
		4	*23757.077*		
$5d^2$	$5d^2\ ^1D$	2	23062.06		
$5d(^2D)6p$	$6p'\ ^1D^\circ$	2	*23074.416*		
$5d^2$	$5d^2\ ^3P$	0	23209.11	270.90	
		1	23480.01	438.93	
		2	23918.94		
$5d(^2D)6p$	$6p'\ ^3D^\circ$	1	*24192.057*	339.479	0.54
		2	*24531.536*	448.323	1.16
		3	*24979.859*		1.32
$5d(^2D)6p$	$6p'\ ^3P^\circ$	0	*25642.157*	61.983	
		1	*25704.140*	252.409	1.52
		2	*25956.549*		1.52
$6s(^2S)7s$	$7s\ ^3S$	1	26160.284		
$5d(^2D)6p$	$6p'\ ^1F^\circ$	3	*26816.293*		1.09
$6s(^2S)7s$	$7s\ ^1S$	0	28230.08		
$5d(^2D)6p$	$6p'\ ^1P^\circ$	1	*28554.257*		1.02
$6s(^2S)6d$	$6d\ ^1D$	2	30236.815		
$6s(^2S)6d$	$6d\ ^3D$	1	30695.594	55.075	
		2	30750.669	67.441	1.11
		3	30818.110		1.32
$6s(^2S)7p$	$7p\ ^3P^\circ$	0	*30743.533*	72.029	
		1	*30815.562*	171.715	
		2	*30987.277*		
$6s(^2S)7p$	$7p\ ^1P^\circ$	1	*32547.076*		1.07
$5d(^2D)7s$	$7s'\ ^3D$	1	32804.99	138.61	
		2	32943.60	582.81	
		3	33526.41		
$5d(^2D)7s$	$7s'\ ^1D$	2	33795.84		
$6s(^2S)8s$	$8s\ ^3S$	1	33905.349		
$6p^2$	$6p^2\ ^1S$	0	34370.78		
$6p^2$	$6p^2\ ^3P$	0	34493.898	329.522	
		1	34823.420	793.527	1.53
		2	35616.947		1.56
$6s(^2S)4f$	$4f\ ^3F^\circ$	2	*34602.802*	13.881	0
		3	*34616.683*	14.126	
		4	*34630.809*		
$6s(^2S)4f$	$4f\ ^1F^\circ$	3	*34736.423*		0.
$6p^2$	$6p^2\ ^1D$	2	35344.423		1.21
$6s(^2S)7d$	$7d\ ^3D$	1	35709.308	52.903	
		2	35762.211	23.091	
		3	35785.302		

Ba I

Config.	Desig.	J	Level	Interval	Obs. g
$6s(^2S)8p$	$8p\ ^1P^\circ$	1	*35892.518*		
$5d(^2D)6d$	$6d'\ ^3G$	3	35894.28	454.70	
		4	36348.98	488.52	
		5	36837.50		
$5d(^2D)6d$	$6d'\ ^3D$	1	35933.825	266.598	
		2	36200.423	428.45	
		3	36628.87		
$5d(^2D)6d$	$6d'\ ^1F$	3	36165.311		1.50
$5d(^2D)7p$	$7p'\ ^3F^\circ$	2	*36234.858*	276.408	
		3	*36511.266*	620.818	
		4	*37132.084*		
$5d(^2D)6d$	$6d'\ ^3S$	1	36446.583		
$5d(^2D)7p$	$7p'\ ^3D^\circ$	1	*36495.770*	567.54	
		2	*37063.31*	476.93	
		3	*37540.238*		
$5d(^2D)6d$	$6d'\ ^1P$	1	36902.55		
$5d(^2D)7p$	$7p'\ ^3P^\circ$	0	*36908.01*	82.01	
		1	*36990.016*	292.06	
		2	*37282.08*		
$6s(^2S)8s$	$8s\ ^1S$	0	37041.00		
$5d(^2D)7p$	$7p'\ ^1D^\circ$	2	*37077.50*		
$5d(^2D)6d$	$6d'\ ^3F$	2	37088.844	415.18	
		3	37504.02	228.21	
		4	37732.23		
$6s(^2S)9s$	$9s\ ^3S$	1	37095.492		
$6s(^2S)5f$	$5f\ ^1F^\circ$	3	*37282.175*		
$6s(^2S)5f$	$5f\ ^3F^\circ$	2	*37394.925*	24.042	
		3	*37418.967*	105.217	
		4	*37524.184*		
$6s(^2S)7d$	$7d\ ^1D$	2	37434.956		
$5d(^2D)6d$	$6d'\ ^3P$	0	37675.84	347.38	
		1	38023.22	244.45	
		2	38267.67		
$5d(^2D)7p$	$7p'\ ^1F^\circ$	3	*37739.96*		
$6s(^2S)9p$	$9p\ ^1P^\circ$	1	*37774.50*		
$5d(^2D)6d$	$6d'\ ^1D$	2	37837.40		
$6s(^2S)8d$	$8d\ ^3D$	1	37961.919	12.272	
		2	37974.191	14.294	
		3	37988.485		
$5d(^2D)6d$	$6d'\ ^1G$	4	38177.10		
$6s(^2S)9s$	$9s\ ^1S$	0	38267.59		
$5d(^2D)7p$	$7p'\ ^1P^\circ$	1	*38499.852*		
$6s(^2S)8d$	$8d\ ^1D$	2	38556.18		
$(^2S)10s$	$10s\ ^3S$	1	38662.91		
$(^2S)6f$	$6f\ ^3F^\circ$	2	*38815.735*	2.683	
		3	*38818.418*	6.847	
		4	*38825.265*		
$6s(^2S)6f$	$6f\ ^1F^\circ$	3	*38884.00*		
$6s(^2S)9d$	$9d\ ^3D$	1	39140.70	17.19	
		2	39157.89	27.86	
		3	39185.75		

Ba I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$6s(^2S)10p$	$10p\ ^1P^\circ$	1	*39308.74*		
$6s(^2S)9d$	$9d\ ^1D$	2	39334.94		
$6s(^2S)11s$	$11s\ ^3S$	1	39624.69		
$6s(^2S)7f$	$7f\ ^3F^\circ$	2 3 4	*39678.06* *39680.62* *39683.02*	2.56 2.40	
$6s(^2S)7f$	$7f\ ^1F^\circ$	3	*39705.11*		
$5d(^2D)4f$?	$4f'\ ^3F^\circ$?	2 3 4	*39765.31*		
$6s(^2S)10d$	$10d\ ^3D$	1 2 3	39892.19 39894.53 39905.15	2.34 10.62	
		1 or 2	*39905.45*?		
$6s(^2S)11p$	$11p\ ^1P^\circ$	1	*39984.75*		
$6s(^2S)8f$	$8f\ ^3F^\circ$	2 3 4	*40238.91* *40241.37* *40244.02*	2.46 2.65	
$6s(^2S)8f$	$8f\ ^1F^\circ$	3	*40257.63*		
$6s(^2S)11d$	$11d\ ^3D$	1 2 3	 40380.32 40382.68	2.36	
$6s(^2S)12p$	$12p\ ^1P^\circ$	1	*40421.23*		
$6s(^2S)9f$	$9f\ ^1F^\circ$	3	*40614.15*		
$6s(^2S)9f$	$9f\ ^3F^\circ$	2 3 4	*40614.16* *40621.80* *40627.78*	7.64 5.98	
$6s(^2S)10f$	$10f\ ^3F^\circ$	2 3 4	*40895.27* *40898.69* *40897.07*	3.42 −1.62	
$6s(^2S)11f$	$11f\ ^3F^\circ$	4 3 2	*41096.50* *41096.88* *41100.25*	−0.38 −3.37	
$6s(^2S)12f$	$12f\ ^3F^\circ$	4 3 2	*41247.58* *41247.04* *41250.56*	0.54 −3.52	
$6s(^2S))13f$	$13f\ ^3F^\circ$	4 3 2	*41364.65* *41364.36*	0.29	
$6s(^2S)14f$	$14f\ ^3F^\circ$	4, 3, 2	*41456.78*		
$6s(^2S)15f$	$15f\ ^3F^\circ$	4, 3, 2	*41530.05*		
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Ba II ($^2S_{1/2}$)	*Limit*	------	42032.4		

December 1955.

Ba I Observed Terms*

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 5s^2\ 5p^6+$	Observed Terms	
$6s^2$	$6s^2\ ^1S$	
$5d^2$	$5d^2\ ^3P$ $5d^2\ ^1D$	
$6p^2$	$6p^2\ ^1S$ $6p^2\ ^3P$ $6p^2\ ^1D$	
	$ns\ (n\geq 7)$	$np\ (n\geq 6)$
$6s(^2S)nx$	7–11s ^3S 7– 9s ^1S	6, 7p $^3P^\circ$ 6–12p $^1P^\circ$
$5d(^2D)nx'$	$7s'\ ^3D$ $7s'\ ^1D$	6, 7p' $^3P^\circ$ 6, 7p' $^3D^\circ$ 6, 7p' $^3F^\circ$ 6, 7p' $^1P^\circ$ 6, 7p' $^1D^\circ$ 6, 7p' $^1F^\circ$
	$nd\ (n\geq 5)$	$nf\ (n\geq 4)$
$6s(^2S)nx$	5–11d ^3D 5– 9d ^1D	4–15f $^3F^\circ$ 4– 9f $^1F^\circ$
$5d(^2D)nx'$	$6d'\ ^3S$ $6d'\ ^3P$ $6d'\ ^3D$ $6d'\ ^3F$ $6d'\ ^3G$ $6d'\ ^1P$ $6d'\ ^1D$ $6d'\ ^1F$ $6d'\ ^1G$	$4f'\ ^3F^\circ$?

*For predicted terms in the spectra of the Ba I isoelectronic sequence, see Volume III, Introduction.

Ba II

(Cs I sequence; 55 electrons) $Z=56$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,5s^2\,5p^6\,6s\ {}^2S_{0\frac{1}{2}}$

$6s\ {}^2S_{0\frac{1}{2}}$ 80686.87 K I. P. 10.001 volts

Although the early work on this spectrum has been revised and extended, a monograph on Ba II is needed. The series are well known, but the observed wavelengths are heterogeneous and do not give precise level-values throughout.

The analysis is from Rasmussen, supplemented by additional series members reported by Saunders, Schneider, and Buckingham. Interferometric measurements have been made for a few lines of Ba II. Sullivan and Burns have utilized their observations to derive improved values for six terms. With these as a start the writer has adjusted the decimals of other terms from the wavelengths given by Rasmussen. Rounded off entries in the table are from ultraviolet measurements in the 1934 reference.

The limit is from the ${}^2G$ series reported by Rasmussen. He notes that the ${}^2F$ series exhibits perturbations such as are well known in Al II.

Approximately 85 lines are classified between 1397 A and 14000 A.

The observed g-values entered in the table for $6s\ {}^2S_{0\frac{1}{2}}$ and $6p\ {}^2P^{\circ}_{0\frac{1}{2}}$ have been determined at the National Bureau of Standards from Zeeman spectrograms on which the line at 4934 A appeared as an impurity. The other g-values have been derived by the writer from observations of the lines at 5854 A and 6141 A, reported by Back; and from those given by Moore.

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Ba II

Config.	Desig.	J	Level	Interval	Obs. g
$5p^6({}^1S)6s$	$6s\ {}^2S$	$0\frac{1}{2}$	0.00		1.974
$5p^6({}^1S)5d$	$5d\ {}^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	4873.850 5674.824	800.974	0.79 1.12
$5p^6({}^1S)6p$	$6p\ {}^2P^{\circ}$	$0\frac{1}{2}$ $1\frac{1}{2}$	*20261.562* *21952.422*	1690.860	0.672 1.32
$5p^6({}^1S)7s$	$7s\ {}^2S$	$0\frac{1}{2}$	42355.182		1.98
$5p^6({}^1S)6d$	$6d\ {}^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	45949.496 46154.89	205.39	0.79 1.18
$5p^6({}^1S)4f$	$4f\ {}^2F^{\circ}$	$2\frac{1}{2}$ $3\frac{1}{2}$	*48258.590* *48483.29*	224.70	
$5p^6({}^1S)7p$	$7p\ {}^2P^{\circ}$	$0\frac{1}{2}$ $1\frac{1}{2}$	*49390.05* *50011.22*	621.17	
$5p^6({}^1S)5f$	$5f\ {}^2F^{\circ}$	$2\frac{1}{2}$ $3\frac{1}{2}$	*57390.93* *57631.64*	240.71	
$5p^6({}^1S)8s$	$8s\ {}^2S$	$0\frac{1}{2}$	58025.18		
$5p^6({}^1S)7d$	$7d\ {}^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	59800.31 59894.98	94.67	
$5p^6({}^1S)8p$	$8p\ {}^2P^{\circ}$	$0\frac{1}{2}$ $1\frac{1}{2}$	*61336* *61636*	300	
$5p^6({}^1S)5g$	$5g\ {}^2G$	$\left\{\begin{matrix}3\frac{1}{2}\\4\frac{1}{2}\end{matrix}\right\}$	63026.53		
$5p^6({}^1S)6f$	$6f\ {}^2F^{\circ}$	$2\frac{1}{2}$ $3\frac{1}{2}$	*64596.31* *64697.08*	100.77	
$5p^6({}^1S)9s$	$9s\ {}^2S$	$0\frac{1}{2}$	65683.41		
$5p^6({}^1S)8d$	$8d\ {}^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	66673.80 66725.41	51.61	
$5p^6({}^1S)6g$	$6g\ {}^2G$	$\left\{\begin{matrix}3\frac{1}{2}\\4\frac{1}{2}\end{matrix}\right\}$	68425.87		
$5p^6({}^1S)7f$	$7f\ {}^2F^{\circ}$	$2\frac{1}{2}$ $3\frac{1}{2}$	*69211.70* *69260.46*	48.76	
$5p^6({}^1S)10s$	$10s\ {}^2S$	$0\frac{1}{2}$	70014.72		

Ba II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$5p^6(^1S)9d$	$9d\ ^2D$	1½ 2½	70620.40 70651.87	31.47	
$5p^6(^1S)7g$	$7g\ ^2G$	{3½ 4½}	71682.38		
$5p^6(^1S)8f$	$8f\ ^2F^\circ$	2½ 3½	*72142.72* *72170.19*	27.47	
$5p^6(^1S)11s$	$11s\ ^2S$	0½	72705.33		
$5p^6(^1S)10d$	$10d\ ^2D$	1½ 2½	73101.90 73122.23	20.33	
$5p^6(^1S)8g$	$8g\ ^2G$	{3½ 4½}	73795.84		
$5p^6(^1S)9f$	$9f\ ^2F^\circ$	2½ 3½	*74091.00* *74108.98*	17.92	
$5p^6(^1S)12s$	$12s\ ^2S$	0½	74491.51		
$5p^6(^1S)11d$	$11d\ ^2D$	1½ 2½	74765.73 74779.66	13.93	
$5p^6(^1S)9g$	$9g\ ^2G$	{3½ 4½}	75244.09		
$5p^6(^1S)10f$	$10f\ ^2F^\circ$	2½ 3½	*75438* *75451*	13	
$5p^6(^1S)12d$	$12d\ ^2D$	1½ 2½	75945.85		
$5p^6(^1S)10g$	$10g\ ^2G$	{3½ 4½}	76279.64		
$5p^6(^1S)11f$	$11f\ ^2F^\circ$	2½ 3½	*76413* *76429*	16	
$5p^6(^1S)11g$	$11g\ ^2G$	{3½ 4½}	77046		
$5p^6(^1S)12g$	$12g\ ^2G$	{3½ 4½}	77628		
Ba III ($^1S_0$)	*Limit*	-----	**80686.87**		

February 1954.

Ba IV

(I I sequence; 53 electrons) $Z=56$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 5s^2\ 5p^5\ ^2P^\circ_{1\frac{1}{2}}$

$5p^5\ ^2P^\circ_{1\frac{1}{2}}$ K I. P. volts

This spectrum is very incompletely analyzed. Fitzgerald and Sawyer have reported the 22 levels in the table. These levels account for 53 classified lines; 13 between 570.1 A and 740.0 A, and 40 between 2220.15 A and 4591.72 A. The writer has labeled the third level, $5p^6\ ^2S$, by analogy with Xe II. The authors state that the levels in the middle group are probably from the $5s^2\ 5p^4\ 5d$ and $5s^2\ 5p^4\ 6s$ configurations, whereas the higher odd levels, 196000 K to 198000 K, are probably from $5s^2\ 5p^4\ 6p$.

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M. A. Fitzgerald and R. A. Sawyer, Phys. Rev. **46**, 576 (1934). (T) (C L)

Ba IV

Config.	Desig.	J	Level	Interval
$5s^2\ 5p^5$	$5p^5\ ^2P^\circ$	1½ 0½	*0* *17830*	−17830
$5s\ 5p^6$	$5p^6\ ^2S$	0½	152963	
		2½	154481	
		3½	154631	
		0½ or 1½	156738	
		3½	157656	
		0½	157741	
		2½	158170	
		2½	158444	
		3½	158750	
		2½	158998	
		2½	163254	
		1½	175431	
		2½	175926	
		2½	*196549*	
		2½	*197504*	
		3½	*197698*	
		1½	*197711*	
		1½	*198005*	
		2½	*198758*	
		2½	*198889*	

January 1954.

LANTHANUM

La I

57 electrons $Z=57$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 5s^2\ 5p^6\ 5d\ 6s^2\ {}^2D_{1\frac{1}{2}}$

$a\ {}^3D_{1\frac{1}{2}}$ 45293 K — I. P. 5.61 ±0.03 volts

The analysis is from Russell and Meggers and is based on Meggers' observations of Zeeman effects and wavelengths, which cover the range 2647.13 A to 10954.6 A. There are 540 classified lines. Observed intersystem combinations connect the doublet and quartet systems of terms.

The analysis is well confirmed by the 1932 Zeeman observations, but the earlier measurements have since been largely supplanted by further study at the Massachusetts Institute of Technology. All but eight of the g-values in the table are from the 1945 reference.

The limit is from three series of two members each, namely, 6, 7s ${}^4F$, 6, 7s ${}^2F$, and $6s^2$ ${}^2D$, 7s ${}^4D$. By comparison with Ca I, Sr I, and Ba I, the authors introduced a correction to the differences of the Rydberg denominators amounting to $\Delta n^*=1.060$ for the ${}^4F$ and ${}^2F$ series, and $\Delta n^*=1.010$ for the ${}^2D$, ${}^4D$ series.

The authors point out the significant fact that the electron configurations of the lanthanum atom anticipate "the atom building process which accounts for the rare-earth elements."

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La I

Config.	Desig.	J	Level	Interval	Obs. g
$5d\ 6s^2$	$a\ {}^2D$	1½	0.00	1053.20	0.798
		2½	1053.20		1.198
$5d^2(a\ {}^3F)6s$	$a\ {}^4F$	1½	2668.20	341.81	0.405
		2½	3010.01	484.57	1.030
		3½	3494.58	627.03	1.239
		4½	4121.61		1.338
$5d^2(a\ {}^3F)6s$	$a\ {}^2F$	2½	7011.90	1040.25	0.893
		3½	8052.15		1.137
$5d^2(a\ {}^3P)6s$	$a\ {}^4P$	0½	7231.36	259.10	2.648
		1½	7490.46	189.48	1.704
		2½	7679.94		1.498
$5d^2(b\ {}^1D)6s$	$b\ {}^2D$	1½	8446.03	737.74	0.942
		2½	9183.77		1.250
$5d^2(a\ {}^3P)6s$	$a\ {}^2P$	0½	9044.21	675.23	0.690
		1½	9719.44		1.23
$5d^2(a\ {}^1G)6s$	$a\ {}^2G$	4½	9919.94	−41.02	1.12
		3½	9960.96		0.91

La I

Config.	Desig.	J	Level	Interval	Obs. g
$5d\ 6s(a\ {}^3D)6p$	$z\ {}^4F°$	1½	*13260.36*	370.72	0.93
		2½	*13631.08*	1388.47	1.096
		3½	*15019.55*	1223.70	1.23
		4½	*16243.25*		
$5d\ 6s(a\ {}^3D)6p$	$z\ {}^4D°$	0½	*14095.70*	613.26	
		1½	*14708.96*	794.71	
		2½	*15503.67*	595.61	
		3½	*16099.28*		
$5d\ 6s(a\ {}^1D)6p$	$z\ {}^2D°$	2½	*14804.10*	−227.55	1.08
		1½	*15031.65*		0.917
$5d\ 6s(a\ {}^1D)6p$	$z\ {}^2F°$	2½	*15196.80*	1341.64	0.906
		3½	*16538.44*		1.19
$6s^2(a\ {}^1S)6p$	$z\ {}^2P°?$	0½	*15219.90*	1060.30	
		1½	*16280.20*		1.329
$5d\ 6s(a\ {}^3D)6p$	$y\ {}^2F°$	2½	*16856.82*	1053.36	0.810
		3½	*17910.18*		1.086
$5d\ 6s(a\ {}^3D)6p$	$z\ {}^4P°$	0½	*17567.56*	229.74	
		1½	*17797.30*	359.70	
		2½	*18157.00*		1.175

La I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$5d^2(a\,^3F)6p$	$z\,^4G^\circ$	2½	17947.16	656.79	1.063
		3½	18603.95	525.39	1.051
		4½	19129.34	988.06	1.173
		5½	20117.40		1.290
$5d\,6s(a\,^3D)6p$	$y\,^2D^\circ$	1½	18172.39	1207.05	0.802
		2½	19379.44		1.186
$5d\,6s(a\,^1D)6p$	$y\,^2P^\circ$	1½	20019.00	−178.38	1.020
		0½	20197.38		0.60
$5d^2(a\,^3F)6p$	$y\,^4F^\circ$	1½	20083.02	255.28	0.731
		2½	20338.30	425.01	1.013
		3½	20763.31	620.75	1.178
		4½	21384.06		1.278
$5d^2(a\,^3F)6p$	$z\,^2F^\circ$	2½	20972.22	690.39	0.894
		3½	21662.61		0.995
$5d^2(a\,^3F)6p$	$z\,^2G^\circ$	3½	21447.92	837.93	1.103
		4½	22285.85		1.15
$5d^2(a\,^3F)6p$	$y\,^4D^\circ$	0½	22246.64	192.73	−0.22?
		1½	22439.37	364.89	1.192
		2½	22804.26	499.05	1.362
		3½	23303.31		1.183
	1°	3½	23221.16		1.078
$5d^2(a\,^3P)6p$	$z\,^2S^\circ$	0½	23260.90		1.89
	2°	4½	23466.85		1.12
$5d^2(a\,^3P)6p$	$x\,^4D^\circ$	0½	23528.38	176.38	0.152
		1½	23704.76	341.30	1.135
		2½	24046.06	1037.36	1.272
		3½	25083.42		1.379
	3°	2½	23549.42		1.16
$5d\,6s(a\,^3D)4f$	$w\,^2F^\circ$	2½	23875.00	534.70	0.957
		3½	24409.70		1.17
	4°	1½	24173.86		0.72
	$v\,^2F^\circ$?	2½	24507.89	870.57	1.159
		3½	25378.46		1.13
$5d^2(a\,^3P)6p$	$z\,^4S^\circ$	1½	24639.27		1.781
$5d^2(a\,^3F)6p$	$x\,^2D^\circ$	1½	24762.62	455.63	0.855
		2½	25218.25		1.244
$5d^2(a\,^3F)4f$	$x\,^4F^\circ$	1½	24910.39	73.94	0.724
		2½	24984.33	396.00	1.063
		3½	25380.33	616.94	1.228
		4½	25997.27		1.319
$5d^2(a\,^1G)6p$	$z\,^2H^\circ$	4½	25089.50	785.18	0.94
		5½	25874.68		1.11
$5d\,6s(a\,^3D)6p$	$x\,^2P^\circ$	0½	25453.92	496.47	0.985
		1½	25950.39		1.433
	31		25568.49		
$5d^2(a\,^3P)6p$	$y\,^4P^\circ$	0½	25616.90	26.12	2.29
		1½	25643.02	695.88	1.600
		2½	26338.90		1.524
	32	5½	25881.53		
$5d^2(a\,^3F)4f$	$y\,^4G^\circ$	2½	27022.60	432.74	0.57
		3½	27455.34	633.84	0.976
		4½	28089.18	654.03	1.159
		5½	28743.21		1.28
$5d^2(a\,^1G)6p$	$y\,^2G^\circ$	3½	27132.50	487.19	0.94
		4½	27619.69		1.12

La I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$5d^2(b\,^1D)6p$	$w\,^2P^\circ$	0½			
		1½	27225.27		1.335
$5d^2(b\,^1D)6p$	$u\,^2F^\circ$	2½	27393.00	646.54	0.888
		3½	28039.54		1.13
$4f$	$t\,^2F^\circ$	2½	27669.38	873.72	0.87
		3½	28543.10		1.00
	5°	1½	27749.05		
$5d^2(b\,^1D)6p$	$w\,^2D^\circ$	1½	27968.53	537.86	0.836
		2½	28506.39		1.20
$5d^2(a\,^3P)4f$	$w\,^4D^\circ$	0½	28893.47	306.06	0.00
		1½	29199.53	302.64	1.15
		2½	29502.17	392.74	1.263
		3½	29894.91		1.352
$4f$	$v\,^2D^\circ$	1½	28971.82	803.75	0.71
		2½	29775.57		1.253
	33		29461.33		
	6°	0½	29564.92		
	34?		29594.81		
$5d^2(a\,^3F)7s$	$e\,^4F$	1½	29874.89	479.43	0.93
		2½	30354.32	705.37	
		3½	31059.69	864.21	
		4½	31923.90		
	7°	1½	29936.73		1.492
	8°	1½	30417.47		1.533
$5d^2(a\,^1G)6p$	$s\,^2F^\circ$	2½	30788.40	176.42	1.043
		3½	30964.82		1.16
	9°	2½	30896.88		1.424
$5d^2(a\,^3F)7s$	$e\,^2F$	2½	31119.08	989.50	
		3½	32108.58		
$5d\,6s(a\,^3D)7s$	$e\,^4D$	0½			
		1½			
		2½			
		3½	31287.65		
$4f$	$r\,^2F^\circ$	2½	31477.16	663.44	0.92
		3½	32140.60		1.16
$5d^2(a\,^3P)6p$	$u\,^2D^\circ$	1½	31751.68	741.12	0.80
		2½	32492.80		1.145
$5d^2(a\,^3P)6p$	$v\,^2P^\circ$	0½	32290.25	913.95	0.70
		1½	33204.20		1.27
$5d^2(a\,^1G)4f$	$y\,^2H^\circ$	4½	32410.76	107.36	0.92
		5½	32518.12		1.11
	35		33286.50		
	10°		36722.38		
	11°	3½?	37731.90		1.18?
	12°?		39597.58		
	13°		39631.27		
	14°		40322.45		
	15°		40343.40		
La II$(a\,^3F_2)$	*Limit*	-----	45293		

La I Observed Terms*

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}$ $4s^2\,4p^6\,4d^{10}\,5s^2\,5p^6+$	Observed Terms		
$5d\,6s^2$	$a\,^2D$		
	$ns\ (n\geq 6)$	$np\ (n\geq 6)$	$nf\ (n\geq 4)$
$5d^2(a\,^3F)nx$	$a,\,e\,^4F$ $a,\,e\,^2F$	$y\,^4D^\circ$ $y\,^4F^\circ$ $z\,^4G^\circ$ $z\,^2D^\circ$ $z\,^2F^\circ$ $z\,^2G^\circ$	$z\,^4F^\circ$ $y\,^4G^\circ$
$5d\,6s(a\,^1D)nx$		$y\,^2P^\circ$ $z\,^2D^\circ$ $z\,^2F^\circ$	
$5d\,6s(a\,^3D)nx$	$e\,^4D$	$z\,^4P^\circ$ $z\,^4D^\circ$ $z\,^4F^\circ$ $z\,^2P^\circ$ $y\,^2D^\circ$ $y\,^2F^\circ$	$w\,^2F^\circ$
$5d^2(a\,^3P)nx$	$a\,^4P$ $a\,^2P$	$z\,^4S^\circ$ $y\,^4P^\circ$ $x\,^4D^\circ$ $z\,^2S^\circ$ $x\,^2P^\circ$ $u\,^2D^\circ$	$w\,^4D^\circ$
$6s^2(a\,^1S)nx$		$x\,^2P^\circ$?	
$5d^2(a\,^1G)nx$	$a\,^2G$	$x\,^2F^\circ$ $y\,^2G^\circ$ $z\,^2H^\circ$	$y\,^2H^\circ$
$5d^2(b\,^1D)nx$	$b\,^2D$	$w\,^2P^\circ$ $w\,^2D^\circ$ $u\,^2F^\circ$	

*For predicted terms in the spectra of the La I isoelectronic sequence, see Vol. III, Introduction.

La II

(Ba I sequence; 56 electrons) $Z=57$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,5s^2\,5p^6\,5d^2\ {}^3F_2$

$a\ {}^3F_2$ **92240 K** I. P. 11.43 ± 0.07 volts

Meggers' observations from 2142.81 A to 10954.6 A have resulted in the classification of 728 lines. The extensive analysis by Russell and Meggers is of particular interest because the study of La I, La II, and La III "shows that the atom building process which accounts for the rare-earth elements is actually anticipated in the electron configurations of the lanthanum atom." In addition, La II "is the most completely developed example of a 2-electron spectrum which has yet been investigated;" at least ten types of configurations are known "and almost all of the terms arising from each."

The Zeeman observations available in 1932 were extremely useful in assigning the term designations, but have since been improved and extended at the Massachusetts Institute of Technology. The g-values in the table are from the 1945 paper.

The dubious ${}^1D_2$ term at 64706.76? has been rejected.

The limit has been derived from the $ns\ {}^{1,3}D$ series ($n=6,7$) having the limit $5d\ {}^2D$ in La III, and the $nd\ {}^3D$ series ($n=5,6$) having the limit $6s\ {}^2S$. The term $a\ {}^3D$ is used in both, since $a\ {}^1D$ and $a\ {}^3D$, belong to both the $5d(^2D)6s$ and the $6s(^2S)5d$ configurations. In determining the limit the authors have assumed the difference in the Rydberg denominators, $\Delta n^*=1.05$ for a running s-electron and 1.15 for a running d-electron, by analogy with Ca I, Sr I, and Ba I.

The authors ascribe two triads ${}^3P^\circ D^\circ F^\circ$ and ${}^1P^\circ D^\circ F^\circ$ to "$6p\,5d$" electrons. In assigning limits these electrons could belong with either of two limits, namely, $6p(^2P^\circ)5d$ or $5d(^2D)6p$. Since the ${}^2D$ limit term is the ground term in La III and the ${}^2P^\circ$ limit is 42014 K above the ground term, the triads are here entered with the lower limit.

Observed intersystem combinations connect the triplet and singlet systems of terms.

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La II

Config.	Desig.	J	Level	Interval	Obs. g
$5d^2$	$a\ {}^3F$	2	0.00	1016.10	0.721
		3	1016.10	954.60	1.083
		4	1970.70		1.248
$5d(^2D)6s$	$a\ {}^1D$	2	1394.46		0.977
$5d(^2D)6s$	$a\ {}^3D$	1	1895.15	696.45	0.498
		2	2591.60	658.75	1.133
		3	3250.35		1.334
$5d^2$	$a\ {}^3P$	0	5249.70	468.42	0/0
		1	5718.12	509.30	1.497
		2	6227.42		1.481
$6s^2$	$a\ {}^1S$	0	7394.57		0/0

La II

Config.	Desig.	J	Level	Interval	Obs. g
$5d^2$	$a\ {}^1G$	4	7473.32		1.000
$5d^2$	$b\ {}^1D$	2	10094.86		1.005
$6s(^2S)4f$	$z\ {}^3F^\circ$	2	*14147.98*	227.19	0.664
		3	*14375.17*	1323.57	1.056
		4	*15698.74*		1.247
$6s(^2S)4f$	$z\ {}^1F^\circ$	3	*15773.77*		1.017
$5d(^2D)4f$	$z\ {}^1G^\circ$	4	*16599.17*		0.969
$5d(^2D)4f$	$y\ {}^3F^\circ$	2	*17211.93*	1023.63	0.754
		3	*18235.56*	978.98	1.086
		4	*19214.54*		1.232

La II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$5d(^2D)4f$	$z\ ^3H^\circ$	4	17825. 62		0. 846
		5	18580. 41	754. 79	1. 017
		6	19749. 62	1169. 21	1. 178?
$5d(^2D)4f$	$z\ ^1D^\circ$	2	18895. 41		0. 923
$5d(^2D)4f$	$z\ ^3G^\circ$	3	20402. 82		0. 757
		4	21331. 60	928. 78	1. 049
		5	22282. 90	951. 30	1. 197
$5d(^2D)4f$	$z\ ^3D^\circ$	1	21441. 73		0. 542
		2	22106. 02	664. 29	1. 167
		3	22537. 30	431. 28	1. 288
$5d(^2D)4f$	$z\ ^3P^\circ$	0	22683. 70		0/0
		1	22705. 15	21. 45	1. 431
		2	23246. 93	541. 78	1. 459
$5d(^2D)6p$	$y\ ^1D^\circ$	2	24462. 66		0. 887
$5d(^2D)4f$	$y\ ^1F^\circ$	3	24522. 70		1. 034
$5d(^2D)6p$	$y\ ^3D^\circ$	1	25973. 37		0. 782
		2	27388. 11	1414. 74	1. 168
		3	28315. 25	927. 14	1. 308
$5d(^2D)6p$	$z\ ^3F^\circ$	2	26414. 01		0. 825
		3	26837. 66	423. 65	1. 088
		4	28565. 40	1727. 74	1. 245
$5d(^2D)4f$	$z\ ^1P^\circ$	1	27423. 91		0. 876
$5d(^2D)6p$	$y\ ^3P^\circ$	0	27545. 85		0/0
		1	28154. 55	608. 70	1. 267
		2	29498. 05	1343. 50	1. 471
$5d(^2D)4f$	$z\ ^1H^\circ$	5	28525. [illegible]		1. 004
$5d(^2D)6p$	$y\ ^1P^\circ$	1	30353. 33		1. 074
$6s(^2S)6p$	$x\ ^3P^\circ$	0	31785. 82		0/0
		1	32160. 99	375. 17	1. 492
		2	33204. 41	1043. 42	1. 494
$5d(^2D)6p$	$x\ ^1F^\circ$	3	32201. 05		1. 005
$6p(^2P^\circ)4f$	$e\ ^3G$	3	35452. 66		0. 876
		4	37172. 79	1720. 13	1. 127
		5	39018. 74	1845. 95	1. 21
$6p(^2P^\circ)4f$	$e\ ^3F$	2	35787. 53		0. 719
		3	36954. 65	1167. 12	1. 061
		4	37790. 57	835. 92	1. 113
$6p(^2P^\circ)4f$	$e\ ^1F$	3	37209. 71		0. 944
$6p(^2P^\circ)4f$	$e\ ^3D$	1	38534. 11		0. 497
		2	38221. 49	−312. 62	1. 071
		3	39402. 55	1181. 06	1. 274
$6p(^2P^\circ)4f$	$e\ ^1G$	4	39221. 65		1. 059
$6p(^2P^\circ)4f$	$e\ ^1D$	2	40457. 71		1. 036
$6s(^2S)6p$	$x\ ^1P^\circ$	1	45692. 17		0. 999
$5d(^2D)7s$	$f\ ^3D$	1	49733. 13		0. 500
		2	49884. 35	151. 22	1. 117
		3	51228. 57	1344. 22	1. 315
$5d(^2D)7s$	$f\ ^1D$	2	51523. 86		1. 036
$5d(^2D)6d$	$f\ ^1F$	3	52137. 67		0. 987
$5d(^2D)6d$	$g\ ^3D$	1	52169. 66		0. 621
		2	52734. 81	565. 15	1. 154
		3	53689. 56	954. 75	1. 218
$5d(^2D)6d$	$f\ ^3G$	3	52857. 88		0. 861
		4	53333. 37	475. 49	1. 036
		5	54434. 65	1101. 28	1. 21
$5d(^2D)6d$	$e\ ^1P$	1	53302. 56		1. 335
$5d(^2D)6d$	$f\ ^3F$	2	53885. 24		0. 751
		3	54840. 04	954. 80	1. 088
		4	55321. 35	481. 31	1. 136
$5d(^2D)6d$	$e\ ^3S$	1	54365. 80		1. 455
$5d(^2D)6d$	$e\ ^1S$	0	54793. 82		
$5d(^2D)6d$	$e\ ^3P$	0	54964. 19?		
		1	55230. 33	266. 14	1. 552
		2	56036. 60	806. 27	1. 203
$4f^2$	$e\ ^3H$	4	55107. 25		0. 883
		5	55982. 09	874. 84	1. 033
		6	56837. 94	855. 85	1. 14
$5d(^2D)6d$	$g\ ^1D$	2	55184. 05		1. 183
$5d(^2D)6d$	$f\ ^1G$	4	56035. 70		1. 027
	1°	3	57364. 12		1. 07
$4f^2$	$g\ ^3F$	2	57399. 58		0. 675
		3	57918. 50	518. 92	1. 085
		4	58259. 41	340. 91	1. 196
	2°	4	58748. 90		
$4f^2$	$g\ ^1G$	4	59527. 60		1. 046
	3°	2, 3	59612. 64		
$4f^2$	$h\ ^1D$	2	59900. 08		1. 035
$6p^2$	$f\ ^3P$	0	60094. 84		0/0
		1	61128. 83	1033. 99	1. 528
		2	62506. 36	1377. 53	1. 416
	4°	4	60744. 17		1. 25
	5°	3, 4	61017. 66		
	6°	3, 4	61514. 46		0. 97?
$6p^2$	$i\ ^1D$	2	62026. 27		1. 054
$4f^2$	$e\ ^1I$	6	62408. 40		1. 003
$4f^2$	$g\ ^3P$	0	63463. 95		0/0
		1	63703. 18	239. 23	1. 471
		2	64278. 92	575. 74	1. 414
	7°	4	63598. 87		1. 205
$6s(^2S)6d$	$h\ ^3D$	1	64361. 28		0. 506
		2	64529. 90	168. 62	1. 217
		3	64692. 59	162. 69	
	8°	3	64411. 17		0. 97
$6p^2$	$f\ ^1S$	0	66591. 91		0/0
$6p(^2P^\circ)7p$?	$i\ ^3D$	1			
		2			
		3	69233. 90		
$4f^2$	$g\ ^1S$	0	69505. 06		
La III ($^2D_{1½}$)	*Limit*	-----	92240		

March 1954.

La II Observed Terms*

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 5s^2\ 5p^6+$	Observed Terms	
$5d^2$	$a\ ^3P$, $b\ ^1D$, $a\ ^3F$, $a\ ^1G$	
$6s^2$	$a\ ^1S$	
$6p^2$	$f\ ^1S$, $f\ ^3P$, $i\ ^1D$	
$4f^2$	$g\ ^1S$, $g\ ^3P$, $h\ ^1D$, $g\ ^3F$, $g\ ^1G$, $e\ ^3H$, $e\ ^1I$	
	$ns\ (n \geq 6)$	$np\ (n \geq 6)$
$5d(^2D)nx$	$a, f\ ^3D$ $a, f\ ^1D$	$y\ ^3P^\circ$ $y\ ^3D^\circ$ $z\ ^3F^\circ$ $y\ ^1P^\circ$ $y\ ^1D^\circ$ $z\ ^1F^\circ$
$6s(^2S)nx'$		$z\ ^3P^\circ$ $z\ ^1P^\circ$
$6p(^2P^\circ)nx''$		$i\ ^3D$?
	$nd\ (n \geq 5)$	$nf\ (n \geq 4)$
$5d(^2D)nx$	$e\ ^3S$ $e\ ^3P$ $g\ ^3D$ $f\ ^3F$ $f\ ^3G$ $e\ ^1S$ $e\ ^1P$ $g\ ^1D$ $f\ ^1F$ $f\ ^1G$	$z\ ^3P^\circ$ $z\ ^3D^\circ$ $y\ ^3F^\circ$ $z\ ^3G^\circ$ $z\ ^3H^\circ$ $z\ ^1P^\circ$ $z\ ^1D^\circ$ $y\ ^1F^\circ$ $z\ ^1G^\circ$ $z\ ^1H^\circ$
$6s(^2S)nx'$	$h\ ^3D$	$z\ ^3F^\circ$ $z\ ^1F^\circ$
$6p(^2P^\circ)nx''$		$e\ ^3D$ $e\ ^3F$ $e\ ^3G$ $e\ ^1D$ $e\ ^1F$ $e\ ^1G$

*For predicted terms in the spectra of the Ba I isoelectronic sequence, see Vol. III, Introduction.

La III

(Cs I sequence; 55 electrons) $Z=57$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 5s^2\ 5p^6\ 5d\ ^2D_{1\frac{1}{2}}$

$5d\ ^2D_{1\frac{1}{2}}$ 154630 K I. P. 19.17 volts

The analysis is from Russell and Meggers, who have extended the earlier work on La III. Lang has added the $5f\ ^2F^\circ$ and $8s\ ^2S$ terms from his observations in the short-wave region. Fifteen lines between 1081.61 A and 3517.14 A have been classified. The limit is from the 6, $7s\ ^2S$ series. In deriving it, Russell and Meggers have assumed that $\Delta n^* = 1.050$, by comparison with the run of Rydberg denominators in related spectra from K I thru Ba II.

Gibbs and Shoepfle have reported that from additional observations between 500 A and 2100 A they have extended the $ns\ ^2S$ and $nd\ ^2D$ series to six members, and located more $^2P^\circ$ and possibly $^2F^\circ$ and ^2G terms. They also confirm the above limit. Unfortunately, their new terms are not available for inclusion here.

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La III

Config.	Desig.	J	Level	Interval	Obs. g
$5p^6(^1S)5d$	$5d\ ^2D$	1½ 2½	0.00 1603.23	1603.23	
$5p^6(^1S)6s$	$6s\ ^2S$	0½	13590.76		2.10
$5p^6(^1S)6p$	$6p\ ^2P^\circ$	0½ 1½	*42014.92* *45110.64*	3095.72	0.63 1.37
$5p^6(^1S)7s$	$7s\ ^2S$	0½	82345.0		
$5p^6(^1S)6d$	$6d\ ^2D$	1½ 2½	82378.75 82812.51	433.76	
$5p^6(^1S)5f$	$5f\ ^2F^\circ$	2½ 3½	*92454.6* *92534.6*	80.0	
$5p^6(^1S)8s$	$8s\ ^2S$	0½	113496		
La IV($^1S_0$)	*Limit*	----------	154630		

April 1954.

HAFNIUM

Hf I

72 electrons $Z=72$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,4f^{14}\,5s^2\,5p^6\,5d^2\,6s^2\ {}^3F_2$

$6s^2\ {}^3F_2$ K I. P. volts

The analysis is by Meggers, who has made a supreme effort to submit his results for inclusion here just as press copy for this Volume is being concluded. The work is not completed. He plans to make further observations in the shortwave region and to continue the analysis with the aid of electronic computers.

The present line list extends from 1917.73 A to 12043.08 A, and is based on recent observations made at the National Bureau of Standards, by using microwave-excited quartz tubes containing hafnium iodide, as light source. The Zeeman Observations (2600 A to 5000 A) are from spectrograms taken at the Massachusetts Institute of Technology, supplemented by observations (to 8700 A) at the National Bureau of Standards. At present there are approximately 2000 classified lines.

Meggers has pointed out the unique character of the Hf I energy levels. The two sets of levels "odd" and "even" overlap throughout their entire range. This dovetailing of the two sets is so pronounced that it causes confusion if all levels are arranged in numerical order. Consequently, in the table the two sets are listed separately, with the "even" levels preceding the "odd" levels.

The large number of "even" levels for which no term designations can as yet be assigned suggests that the configurations $5d^4$, $5d^2\,6s\,6d$, $5d^2\,6s\,7s$, and possibly $5d^2\,6p^2$ are all represented.

No series can be established with certainty from the existing data. By comparison with neighboring spectra it appears likely that the ionization potential may be near 7 volts, thus placing the limit near 56500 K.

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Hf I

Config.	Desig.	J	Level	Interval	Obs. g
$5d^2\,6s^2$	$a\ {}^3F$	2	0.00	2356.68	0.695
		3	2356.68	2210.96	1.083
		4	4567.64		1.240
$5d^2\,6s^2$	$a\ {}^3P$	0	5521.78	1050.77	0.000
		1	6572.55	2411.20	1.500
		2	8983.75		1.300
$5d^2\,6s^2$	$a\ {}^1D$	2	5638.62		1.165

Hf I

Config.	Desig.	J	Level	Interval	Obs. g
$5d^2\,6s^2$	$a\ {}^1G$	4	10532.54		1.008
$5d^3(b\ {}^4F)6s$	$a\ {}^5F$	1	14092.28	648.40	0.00
		2	14740.68	932.65	1.00
		3	15673.33	1093.27	1.25
		4	16766.60	1134.68	1.36
		5	17901.28		1.40
$5d^3(b\ {}^4P)6s$	$a\ {}^5P$	1	20784.87	123.55	
		2	20908.42	1290.66	1.74
		3	22199.08		

Hf I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$5d^3(b\ ^4F)6s$	$b\ ^3F$	2	23327.71		0.90
		3	22880.24	−447.47	
		4	23252.81	372.57	
$5d^3(\ \ )6s$		5	24065.14		
		2	25084.14		
		3	25281.81		
		3	25678.60		
		3	26715.37		
		1	26918.14		
		4	27074.50		
		2	28200.54		
		1	28527.97		
		2	30146.40		
		3	31054.64		1.09
		2	31119.20		0.89
		2	31619.97		1.02
		1	32091.59		1.16
		1	34991.64		0.50
		2	35115.28		1.11
		3	36523.84		1.26
		2	37038.83		1.06?
		1	37336.20		0.48
		2	38289.38		1.09
		3	39127.61		1.31
		1	39286.19		0.22
		1	39546.34		0.81
		2	39788.89		1.02
		1	39790.70		0.58
		0	39848.87		
		2	40180.23		1.21
		2	40513.55		1.11
		1	40618.62		1.50
		2	40636.26		1.07?
		3	40882.06		1.23
		2	41211.03		1.45
		2	41298.36		0.83
		3	41475.84		1.27?
		3	41739.36		1.33
		3	42061.59		
		1	42111.70		
		4	42175.58		1.30?
		4	42283.48		1.34

Hf I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
		3	42360.90		1.15
		4	42670.81		1.24
		2	42719.58		1.19
		1	42782.55		1.53
		2	43016.47		
		3	43489.28		
		1	43561.76		1.47
		4	43838.30		1.30
		5	44131.99		1.40
		2	44375.42		1.35
		4	44777.50		1.25
		3	45083.28		
		2	45254.91		
		1	45270.13		
		3	45364.84		
		1	45474.60		1.41
		3	45649.36		1.18
		2	45728.62		
		3	45994.60		
		2	46056.21		
		2	46183.08		
		3	46280.26		
		4	46282.34		
		2	46437.72		
		2	46860.75		
		2	46961.96		
		3	46966.61		
		4	46992.38		
		2	47304.97		
		3	47345.93		
		4	47606.21		
		2	47702.41		
		1	47874.44		
		3	47938.44		
		4	48022.20		
		3	48049.43		
		1	48129.57		
		3	48319.08		
		4	48356.90		
		2	48407.27		
		2	48594.84		

Hf I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
		3	48598. 99		
		2	48708. 40		
		3	48809. 77		
		3	48869. 43		
		4	49005. 35		
		5	49540. 65		
		4	49623. 40		
		3	49791. 86		
		4	50393. 21		
		5	51408. 65		
$5d^3\,6s(b\,^3D)6p$	$z\,^3D^\circ$	1	*14017. 83*	2145. 53	0. 55
		2	*16163. 36*	2218. 13	1. 17
		3	*18381. 49*		1. 29
$5d^3\,6s(b\,^3D)6p$	$z\,^3F^\circ$	2	*14435. 13*	106. 55	0. 89
		3	*14541. 68*	3683. 31	1. 08
		4	*18224. 99*		1. 24
$5d^3\,6s(a\,^4F)6p$	$z\,^5G^\circ$	2	*18011. 05*	1281. 64	0. 40
		3	*19292. 69*	1667. 40	0. 95
		4	*20960. 09*	1941. 25	1. 16
		5	*22901. 34*		1. 25
		6			
$5d^3\,6s(b\,^3D)6p$	$z\,^3P^\circ$	0	*18270. 11*	−126. 74	0. 00
		1	*18143. 37*	1647. 93	1. 43
		2	*19791. 30*		1. 41
$5d^3\,6s(a\,^4F)6p$	$z\,^5F^\circ$	1	*21738. 70*	711. 86	0. 04
		2	*22450. 56*	998. 05	1. 00
		3	*23448. 61*	1336. 62	1. 20
		4	*24785. 23*	1417. 30	1. 33
		5	*26202. 53*		1. 36
$5d^3\,6s(b\,^3D)6p$	$z\,^1F^\circ$	3	*23644. 74*		1. 075
$5d^3\,6s(a\,^4F)6p$	$z\,^5D^\circ$	0	*24966. 78*	227. 69	0. 00
		1	*25194. 47*	439. 74	1. 45
		2	*25634. 21*	671. 57	1. 42
		3	*26305. 78*	1210. 63	1. 400
		4	*27516. 41*		1. 475
$5d^3\,6s(b\,^3D)6p$	$z\,^1P^\circ$	1	*26463. 93*		1. 000
$5d^3\,6s(a\,^4F)6p$	$y\,^3F^\circ$	2	*27149. 64*	504. 68	1. 00
		3	*27654. 32*	3078. 90	1. 153
		4	*30733. 22*		1. 28
$5d^3\,6s(a\,^2P)6p$	$y\,^3P^\circ$	0	*28526. 19*	−992. 44	0. 00
		1	*27533. 75*	1867. 69	1. 266
		2	*29401. 44*		1. 75
$5d^3\,6s(a\,^2P)6p$	$z\,^3S^\circ$	1	*28047. 91*		1. 94
$5d^3\,6s(a\,^4F)6p$	$y\,^3D^\circ$	1	*28790. 25*	−522. 86	0. 96
		2	*28267. 39*	1729. 42	1. 145
		3	*29996. 81*		1. 23
$5d^3\,6s(a\,^4F)6p$	$z\,^3G^\circ$	3	*28583. 69*	662. 96	0. 95
		4	*29246. 65*	1730. 34	1. 077
		5	*30976. 99*		1. 21
$5d^3\,6s(a\,^4P)6p$	$y\,^5D^\circ$	0			
		1			
		2	*29752. 84*	1589. 67	1. 50
		3	*31342. 51*	600. 80	1. 39
		4	*31943. 31*		1. 41
$5d^3\,6s(b\,^3D)6p$	$z\,^1D^\circ$	2	*31610. 80*		1. 00
		2	*31943. 84*		
$5d^3\,6s(a\,^4P)6p$	$z\,^5P^\circ$	1	*31952. 25*	1169. 23	2. 080
		2	*33121. 48*	17. 64	1. 345
		3	*33139. 12*		1. 442
		3	*32533. 30*		0. 950
		1	*33137. 87*		0. 775
		2	*33538. 15*		0. 822
		3	*33949. 28*		1. 09
		4	*33994. 71*		1. 04
		2	*33994. 86*		0. 93
		1	*34596. 45*		0. 972
		4	*34805. 89*		0. 997
		3	*34877. 04*		0. 960
		2	*34947. 95*		1. 16
		1	*35284. 33*		1. 055
		3	*35453. 83*		1. 002
		5	*35993. 70*		
		4	*36075. 02*		1. 07
		3	*36237. 34*		1. 042
		5	*36419. 26*		
		3	*36609. 85*		1. 255
		2	*36772. 85*		1. 156
		4	*36850. 03*		1. 09
		1	*36949. 29*		0. 53
		4	*37269. 82*		
		1	*38151. 71*		
		2	*38325. 47*		1. 154
		3	*38407. 80*		1. 29
		5	*38845. 44*		
		4	*38987. 83*		1. 14
		3	*39081. 86*		
		3	*39193. 91*		1. 29
		2	*39435. 20*		1. 357
		1	*39704. 41*		0. 625
		2	*40194. 46*		0. 510
		2	*40267. 35*		1. 08
		1	*40704. 12*		1. 15
		3	*40767. 44*		1. 22
		2, 3?	*40957. 54*		
		1	*41193. 97*		
		3	*41422. 43*		

Hf I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
		2	*41768.67*		0.927
		3	*41824.58*		
		1	*42036.37*		1.23
		2	*42302.12*		0.87?
		1	*42485.50*		0.86
		4	*42871.02*		1.15
		3	*43104.71*		1.09
		2	*43517.85*		
		1	*43786.58*		0.17
		1	*43844.63*		
		1	*44257.54*		
		3	*45112.22*		
		2	*45138.88*		
		3	*45455.15*		
		1	*45799.48*		
		2	*46170.12*		
		3	*46775.98?*		
		2	*46981.20*		
		3	*47590.09*		
		4	*48047.90*		
		2	*48951.97*		

June 1957.

Hf I OBSERVED TERMS*

$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6$ +	Observed Terms	
$5d^2\ 6s^2$	$a\ ^3P$, $a\ ^1D$, $a\ ^3F$, $a\ ^1G$	
	$ns\ (n \geq 6)$	$np\ (n \geq 6)$
$5d^2\ 6s(a\ ^4F)nx$		$z\ ^5D^\circ$ $z\ ^5F^\circ$ $z\ ^5G^\circ$ $y\ ^3D^\circ$ $y\ ^3F^\circ$ $z\ ^3G^\circ$
$5d^2\ 6s(a\ ^4P)nx$		$z\ ^5P^\circ$ $y\ ^5D^\circ$
$5d^2\ 6s(b\ ^2D)nx$		$z\ ^3P^\circ$ $z\ ^3D^\circ$ $z\ ^3F^\circ$ $z\ ^1P^\circ$ $z\ ^1D^\circ$ $z\ ^1F^\circ$
$5d^2\ 6s(a\ ^2P)nx$		$z\ ^3S^\circ$ $y\ ^3P^\circ$
$5d^3(b\ ^4F)nx$	$a\ ^5F$ $b\ ^3F$	
$5d^3(b\ ^4P)nx$	$a\ ^5P$	

*For predicted terms in the spectra of the Hf I isoelectronic sequence, see Vol. III, Introduction.

Hf II

(Lu I sequence; 71 electrons) $Z=72$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d\ 6s^2\ ^2D_{1\frac{1}{2}}$

$a\ ^2D_{1\frac{1}{2}}$ **120000 K** I. P. 14.9 volts

The analysis is by Meggers, who has reobserved the spectrum, revised the level values, and extended the 1934 analysis to include approximately 950 classified lines. The new observations extend from 2005.36 A to 8804.35 A. Observed intersystem combinations connect the terms of different multiplicity.

Hf II—Continued

The observed *g*-values are from spectrograms taken by Meggers in 1949 at the Massachusetts Institute of Technology, through the courtesy of G. R. Harrison.

In 1954 Gehatia reported a theoretical study of the low even configurations of Hf II. The agreement between his theoretical and the experimental energy level- and *g*-values is excellent. His predictions have enabled Meggers to find the energy levels $c\ ^2D_{1\frac{1}{2}}$ and $b\ ^2P_{0\frac{1}{2}}$ listed in the table, and will doubtless serve to locate the high $5d^3\ ^2D$ term, when new observations of Hf II in the vacuum region become available.

Although Hf II belongs in the Lu I isoelectronic sequence so far as atomic number is concerned, it does not have the structure of a rare-earth spectrum, to which *f*-electrons contribute. Meggers points out the "remarkable parallelism between the Hf II and La I spectra." From this analogy, together with the assumption that $e\ ^2D$ and $e\ ^4F$ form series with $a\ ^2D$ and $a\ ^4F$, respectively, he derives the approximate value of the limit quoted here. He plans to extend the observations to shorter waves in the near future, with the hope of improving the series.

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Hf II

Config.	Desig.	*J*	Level	Interval	Obs. *g*
$5d\ 6s^2$	$a\ ^2D$	1½ 2½	0.00 3050.88	3050.88	0.787 1.173
$5d^2(a\ ^3F)6s$	$a\ ^4F$	1½ 2½ 3½ 4½	3644.65 4904.85 6344.34 8361.76	1260.20 1439.49 2017.42	0.425 1.052 1.236 1.328
$5d^2(a\ ^3P)6s$	$a\ ^4P$	0½ 1½ 2½	11951.70 12920.94 13485.56	969.24 564.62	2.598 1.664 1.410
$5d^2(a\ ^3F)6s$	$a\ ^2F$	2½ 3½	12070.46 15084.26	3013.80	0.964 1.10
$5d^2(b\ ^1D)6s$	$b\ ^2D$	1½ 2½	14359.42 17368.87	3009.45	1.034 1.273
$5d^2(a\ ^3P)6s$	$a\ ^2P$	0½ 1½	15254.29 17830.34	2576.05	0.737 1.122
$5d^2(a\ ^1G)6s$	$a\ ^2G$	4½ 3½	17389.06 17710.72	−321.66	1.14 0.940
$5d^3$	$b\ ^4F$	1½ 2½ 3½ 4½	18897.64 20134.94 21637.97 23145.57	1237.30 1503.03 1507.60	0.446 1.030 1.221 1.309
$5d^3$	$b\ ^4P$	0½ 1½ 2½	26996.51 27285.13 28547.05	288.62 1261.92	2.58 1.643 1.573
$5d\ 6s(a\ ^3D)6p$	$z\ ^4F°$	1½ 2½ 3½ 4½	*28068.79* *29405.12* *33776.24* *38185.67*	1336.33 4371.12 4409.43	0.512 1.076 1.252 1.33
$5d^3$	$b\ ^2G$	4½ 3½	28104.83 28458.16	−353.33	0.997 0.897
$5d\ 6s(a\ ^3D)6p$	$z\ ^4D°$	0½ 1½ 2½ 3½	*29160.04* *31784.16* *34355.13* *36882.49*	2624.12 2570.97 2527.36	0.486 1.216 1.320 1.380
$5d^3$	$c\ ^2D$	1½ 2½	30594.63 32778.16	2183.53	0.91 1.21

Hf II

Config.	Desig.	*J*	Level	Interval	Obs. *g*
$5d^3$	$a\ ^2H$	5½ 4½	30941.97 31877.74	−935.77	1.10 1.05
$5d\ 6s(a\ ^3D)6p$	$z\ ^2P°$	0½ 1½	*33136.20* *36373.42*	3237.22	0.217 1.323
$5d\ 6s(a\ ^1D)6p$	$z\ ^2D°$	2½ 1½	*33180.92* *34123.93*	−943.01	1.036 0.800
$5d^2(a\ ^3F)6p$	$z\ ^4G°$	2½ 3½ 4½ 5½	*34942.36* *38498.53* *42391.09* *46209.05*	3556.17 3892.56 3817.96	0.981 1.044 1.168 1.27
$5d^3$	$b\ ^2P$	0½ 1½	35146.73 37324.22	2177.49	0.74 1.28
$5d^3$	$b\ ^2F$	2½ 3½	37398.44 37439.66	41.22	 1.14
$5d\ 6s(a\ ^3D)6p$	$y\ ^2D°$	1½ 2½	*37885.90* *41761.24*	3875.34	0.780 1.077
$5d\ 6s(a\ ^3D)6p$	$z\ ^4P°$	0½ 1½ 2½	*38398.56* *39226.46* *40506.86*	827.90 1280.40	2.596 1.615 1.420
$5d\ 6s(a\ ^3D)6p$	$z\ ^2F°$	2½ 3½	*38578.63* *41406.86*	2828.23	0.860 1.105
$5d^2(a\ ^3F)6p$	$y\ ^4F°$	1½ 2½ 3½ 4½	*42518.10* *43680.75* *44399.96* *46124.89*	1162.65 719.21 1724.93	0.562 0.966 1.171 1.223
$5d\ 6s(a\ ^1D)6p$	$y\ ^2P°$	1½ 0½	*42770.56* *43044.26*	−273.70	1.220 0.570
$5d\ 6s(a\ ^1D)6p$	$y\ ^2F°$	2½ 3½	*43900.56* *44690.72*	790.16	1.00 1.142
$5d^2(a\ ^3F)6p$	$y\ ^4D°$	0½ 1½ 2½ 3½	*45643.25* *46674.36* *47904.39* *48930.75*	1031.11 1230.03 1026.36	0.467 1.194 1.326 1.34
$5d^2(a\ ^3P)6p$	$z\ ^2S°$	0½	*46495.37*		1.680
$5d^2(a\ ^3F)6p$	$z\ ^2G°$	3½ 4½	*47157.57* *49840.47*	2682.90	1.028 1.153

Hf II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$5d^2(b\ ^1D)6p$	$z\ ^2D^\circ$	1½ 2½	*47973.56* *49005.64*	1032.08	1.11 1.246
$5d^2(a\ ^3P)6p$	$z\ ^4S^\circ$	1½	*47996.48*		
	$y\ ^4P^\circ$	0½ 1½ 2½	 *50419.49* 		 1.725
$5d^2(a\ ^3F)6p$	$x\ ^2F^\circ$	2½ 3½	*50910.23* *52339.93*	1429.70	0.88 1.162
$5d^2(a\ ^3F)6p$	$w\ ^2D^\circ$	1½ 2½	*51133.59* *52702.59*	1569.00	1.074 1.26
$5d^2(a\ ^3P)6p$	$x\ ^4D^\circ$	0½ 1½ 2½ 3½	*52096.4* *52717.46* *54693.53* *58448.21*	621.1 1976.07 3754.68	0.722 1.43 1.276 1.14
$5d^2(b\ ^1D)6p$	$w\ ^2F^\circ$	2½ 3½	*52204.7* *53227.27*	1022.6	 1.132
$5d^2(b\ ^1D)6p$	$x\ ^2P^\circ$	0½ 1½	*52847.6* *55077.0*	2229.4	 1.28
$5d^2(a\ ^3P)6p$	$x\ ^4P^\circ$	0½ 1½ 2½	*53330.5* *53494.10* *55060.35*	163.6 1566.25	2.394 1.544 1.168
$5d^2(a\ ^1G)6p$	$z\ ^2H^\circ$	4½ 5½	*53546.17* *56571.61*	3025.44	1.02 1.09
$5d^2(a\ ^1G)6p$	$y\ ^2G^\circ$	3½ 4½	*53972.46* *55638.80*	1666.34	1.175 1.06
$5d^2(a\ ^3P)6p$	$w\ ^2P^\circ$	1½ 0½	*56345.74* *57477.6*	−1131.9	1.02 0.72
	$v\ ^2D^\circ$	1½ 2½	 *58117.4*		 1.22
$5d^2(a\ ^3P)6p$	$u\ ^2D^\circ$	1½ 2½	*61318.3* *64664.1*	3345.8	

Hf II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$5d^2(a\ ^1G)6p$	$v\ ^2F^\circ$	2½ 3½	*62774.9* *64442.1*	1667.2	1.05 1.15
	1	2½	65643.9		
$5d^2(a\ ^3F)7p$	2($e\ ^4F$?)	1½	69310.2		
	4	2½	69483.4		
$5d\ 6s(a\ ^3D)7s$	5($e\ ^2D$?)	1½	69963.3		
$5d^2(a\ ^3F)7p$	3($e\ ^4F$?)	2½	70666.0		
	7	1½	72159.1		
	8	1½	73147.2		
$5d\ 6s(a\ ^3D)7s$	6($e\ ^2D$?)	2½	73665.1		
	9	1½	75158.2		
	10	2½	75801.1		
	11	1½	76016.4		
	12	2½	76585.0		
	13	1½	77163.1		
	14	3½	77314.4		
	15	2½	79090.7		
$5d^2(a\ ^1G)7s$	16($e\ ^2G$?)	3½	79804.4		
$5d^2(a\ ^1G)7s$	17($e\ ^2G$?)	4½	81050.9		
	18	4½	82100.5		
	19	4½	83129.8		
Hf III($^3F_2$)	*Limit*	-----	120000		

January 1957.

Hf II Observed Terms*

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$ $3d^{10}\ 4s^2\ 4p^6\ 4d^{10}$ $4f^{14}\ 5s^2\ 5p^6$+	Observed Terms	
$5d\ 6s^2$	$a\ ^2D$	
$5d^3$	$b\ ^4P$ $b\ ^4F$ $b\ ^2P$ $c\ ^2D$ $b\ ^2F$ $b\ ^2G$ $a\ ^2H$	
	ns $(n \geq 6)$	np $(n \geq 6)$
$5d^2(a\ ^3F)ns$	$a, e\ ^4F$ $a\ ^2F$	$y\ ^4D^\circ$ $y\ ^4F^\circ$ $z\ ^4G^\circ$ $w\ ^2D^\circ$ $x\ ^2F^\circ$ $z\ ^2G^\circ$
$5d\ 6s(a\ ^3D)ns$	$e\ ^2D$	$z\ ^4P^\circ$ $z\ ^4D^\circ$ $z\ ^4F^\circ$ $z\ ^2P^\circ$ $y\ ^2D^\circ$ $z\ ^2F^\circ$
$5d^2(a\ ^3P)ns$	$a\ ^4P$ $a\ ^2P$	$z\ ^4S^\circ$ $x\ ^4P^\circ$ $x\ ^4D^\circ$ $z\ ^2S^\circ$ $w\ ^2P^\circ$ $u\ ^2D^\circ$
$5d\ 6s(a\ ^1D)ns$		$y\ ^2P^\circ$ $z\ ^2D^\circ$ $y\ ^2F^\circ$
$5d^2(a\ ^1G)ns$	$a, e\ ^2G$	$v\ ^2F^\circ$ $y\ ^2G^\circ$ $z\ ^2H^\circ$
$5d^2(b\ ^1D)ns$	$b\ ^2D$	$x\ ^2P^\circ$ $x\ ^2D^\circ$ $w\ ^2F^\circ$

*For predicted terms in the spectra of the La I isoelectronic sequence, see Vol. III, Introduction.

TANTALUM

Ta I

73 electrons $Z=73$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^3\ 6s^2\ {}^4F_{1\frac{1}{2}}$

$6s^2\ {}^4F_{1\frac{1}{2}}$ 63600 K I. P. 7.88 volts

The first regularities in Ta I were reported by C. C. Kiess and Mrs. H. K. Kiess in 1933. Subsequently, at the Zeeman Laboratory, Miss van den Berg, Klinkenberg, and van den Bosch extended the study, and reported in 1952 that 1262 lines had been classified. In the 1956 reference below some theoretical aspects of this work are discussed.

The present analysis is by C. C. Kiess and Mrs. H. K. Kiess, who have continued their study of Ta I over a period of nearly 25 years, and furnished their unpublished data especially for inclusion here. Their observations extend from 1953.08 A to 12139.58 A. The total number of classified lines now exceeds 2300. Observed intersystem combinations connect the systems of terms of different multiplicity.

They have not yet completed their analysis, and some designation assignments are tentative, as indicated by a question mark in column two of the table. Many of the levels are listed as miscellaneous owing to the departure from *LS*-coupling. During much of the work, R. E. Trees has generously assisted by providing the predicted positions of even terms derived from his theoretical calculations.

The observed g-values given to three decimal places in the table are from spectrograms taken by Harrison and his colleagues at the Massachusetts Institute of Technology. All Zeeman measurements used for the present work have been made by C. C. Kiess. The resulting observed g-values have been averaged for 46 even levels and 170 odd levels, and the work is still in progress. This wealth of reliable Zeeman data for Ta I exceeds that for any spectrum known to the writer. For example, the tabular g-values for $a\ {}^4F_{1\frac{1}{2}}$ (0.447 ± 0.002), and for $a\ {}^4F_{2\frac{1}{2}}$ (1.031 ± 0.004) each represent means of 38 determinations. For the remaining low even levels the number of individual observations used for the final means fall into the following groups:

No. observations	30 to 34	20 to 28	10 to 15	1 to 9
No. g-values	4	8	5	4

These Zeeman data should provide ideal material for a detailed study of g-sharing and coupling in a complex spectrum.

Many of the Ta I lines exhibit wide hyperfine structure. Means of the hyperfine structure components, weighted by intensity, have been used for such lines in the present work.

The limit is from the $ns\ {}^4F$ series ($n=6$ to 8), and has been determined by means of a Rydberg formula.

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Ta I

Config.	Desig.	J	Level	Interval	Obs. g
$5d^3 6s^2$	$a\,^4F$	1½	0.00	2010.10	0.447
		2½	2010.10	1953.82	1.031
		3½	3963.92	1657.12	1.218
		4½	5621.04		1.272
$5d^3 6s^2$	$a\,^4P$	0½	6049.42	19.49	2.454
		1½	6068.91	3184.52	1.527
		2½	9253.43		1.580
$5d^3 6s^2$	$a\,^2G$	3½	9705.38	984.94	0.912
		4½	10690.32		1.063
$5d^4(a\,^5D)6s$	$a\,^6D$	0½	9758.97	216.84	3.020
		1½	9975.81	1267.82	1.542
		2½	11243.63	991.13	1.641
		3½	12234.76	1116.69	1.578
		4½	13351.45		1.533
$5d^3 6s^2$	$a\,^2P$	1½	10950.22	−841.91	1.407
		0½	11792.13		1.116
$5d^5$	$a\,^6S$	2½	11796.14		2.134
$5d^3 6s^2$	$a\,^2D$	2½	12865.97	−3037.80	1.214
		1½	15903.77		1.199
		2½	14875.70?		
$5d^3 6s^2$	$a\,^2H$	5½	15114.14	−276.87	1.021
		4½	15391.01		1.014
$5d^3 6s^2$	$a\,^2F$	2½	17224.47	158.65	0.882
		3½	17383.12		1.125
$5d^3 6s(a\,^5F)6p$	$z\,^6G^\circ$	1½	*17384.65*	1793.80	
		2½	*19178.45*	1381.81	0.851
		3½	*20560.26*	2121.45	1.194
		4½	*22681.71*	2327.12	1.231
		5½	*25008.83*		1.302
		6½			
		2½	*17993.74*		0.732
$5d^3 6s^2(a\,^3F)6p$	$z\,^4D^\circ$	0½	*18504.72*	1153.06	0.172
		1½	*19657.78*	1509.83	1.018
		2½	*21167.61*	2759.07	1.120
		3½	*23926.68*		1.326
$5d^3 6s^2(a\,^3P)6p$	$z\,^2S^\circ$	0½	*20340.39*		1.956
$5d^4(b\,^3H)6s$	$a\,^4H$	3½	20646.54	506.79	0.818
		4½	21153.33	1275.23	1.089
		5½	22428.56	1086.30	1.159
		6½	23514.86		1.217
$5d^3 6s^2(a\,^3P)6p$	$z\,^2D^\circ$	1½	*20772.32*	1275.13	0.812
		2½	*22047.45*		1.179
		2½	21091.53		
$5d^4(a\,^5D)6s$	$a\,^4D$	0½	22235.97	−854.96	
		1½	21381.01	3165.19	1.020
		2½	24546.20	2028.82	1.294
		3½	26575.02		1.42
$5d^4(b\,^3G)6s$	$a\,^4G$	2½	21622.92	1138.29	0.894
		3½	22761.21	1151.68	1.008
		4½	23912.89	2109.85	1.185
		5½	26022.74		1.260
$5d^3 6s(a\,^5F)6p$	$z\,^4F^\circ$	1½	*21855.07*	1508.02	0.666
		2½	*23363.09*	1618.76	1.078
		3½	*24981.85*	944.49	1.235
		4½	*25926.34*		1.292
		3½	*22380.53*		1.060
		2½	22434.37		
		1½	22842.84		0.894
		5½	23141.4?		
$5d^3 6s(a\,^5F)6p$	$z\,^6F^\circ$	0½	*23355.41*	888.01	−0.320
		1½	*24243.42*	937.70	1.126
		2½	*25181.12*	1404.81	1.239
		3½	*26585.93*	1147.50	1.356
		4½	*27733.43*	2627.79	1.390
	?	5½	*30361.22*		1.334
$5d^4(^3F)6s$	$b\,^4F$	1½			
		2½	23512.34		1.048
		3½			
		4½			
$5d^3 6s(a\,^5F)6p$	$z\,^6D^\circ$	0½	*24516.69*	222.34	2.888
		1½	*24739.03*	2055.73	1.620
		2½	*26794.76*	985.86	1.416
	?	3½	*27780.62*	986.03	1.374
	?	4½	*28766.65*		1.337
		0½	24698.70		
		3½	24917.90		
		4½	24934.58		
		4½	*25185.89*		
		2½	25224.06		
		4½	25376.41		
		1½	25478.30		
$5d^3 6s(a\,^5F)6p$	$y\,^4D^\circ$	0½	*25512.63*	851.06	0.028
		1½	*26363.69*	1770.19	1.393
		2½	*28133.88*		1.394
		3½			
$5d^2 6s^2(a\,^3P)6p$	$z\,^4P^\circ$?	2½	*26219.62*	−370.41	1.338
		1½	*26590.03*	−276.02	1.576
		0½	*26866.05*		2.650
		4½	26678.4?		
		3½	*26960.46*		1.223
		2½	27167.82		1.606
		5½	*27783.0?*		1.351
		3½	*28182.60*		1.115
		5½	28285.99		
		1½	*28689.31*		1.356
		4½	*28766.65*		1.337
		2½	*28862.01*		1.247
		2½	*29343.46*		0.814
		3½	*29722.95*		1.217
$5d^3 6s(a\,^5P)6p$	$y\,^6D^\circ$	0½	*29902.27*	762.39	2.994
		1½	*30664.66*	1822.09	1.812
		2½	*32486.75*	1607.91	1.687
		3½	*34094.66*		1.515
		4½			
		3½	*30015.61*		
		4½	*30021.20*		1.186
		3½	*30590.95*		1.043
$5d^3 6s(a\,^5P)6p$	$z\,^4S^\circ$	1½	*30894.67*		1.808

Ta I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$5d^3\ 6s(a\ ^5P)6p$	$z\ ^6P^\circ$	1½ 2½ 3½	*31066.34* *31961.42* *33197.75*	895.08 1236.33	2.108 1.684 1.568
		2½	*31428.05*		
$5d^2\ 6s^2(a\ ^3P)6p$	$z\ ^2P^\circ$	0½ 1½	*31500.99*		0.758
		4½	*31530.02*		1.086
		1½	*31553.89*		0.888
		3½	*31600.95*		1.089
		3½	*32132.38*		0.846
		1½	*32214.94*		0.728
		5½	*33070.28*		1.349
		2½	*33184.97*		1.273
		4½	*33497.15*		1.031
		4½	*33615.49*		1.067
		2½	*34001.16*		1.140
		1½	*34078.42*		1.089
		2½	*34792.22*		1.483
		3½	*34799.71*		1.210
		4½	*35217.94*		1.582
		1½	*35242.94*		1.534
		4½	*35497.65*		0.940
		1½	*35721.0*		1.010
		3½	*35746.18*		1.101
		5½	*35813.47*		1.200
		2½	*35876.47*		1.490
		2½	*35925.09*		
$5d^3\ 6s(a\ ^3H)6p$	$z\ ^4G^\circ$?	2½ 3½ 4½ 5½	*36013.97* *36799.88* *38813.32* *40510.38*	785.91 13.44 1697.06	0.985 1.133 1.088 1.264
		2½	*36069.2*		
$5d^3\ 6s(a\ ^3H)6p$	$z\ ^4H^\circ$? ?	3½ 4½ 5½ 6½	*36159.13* *37076.71* *38194.22* *39360.68*	917.58 1117.51 1166.46	0.852 1.046 1.061
		0½	*36345.8*		0.536
$5d^3\ 6s(a\ ^3G)6p$	$y\ ^4F^\circ$?	1½ 2½ 3½ 4½	*36580.06* *38447.99*	1867.93	0.716 1.045
		4½	*36631.15*		1.211

Ta I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$5d^3\ 6s(a\ ^3G)6p$	$y\ ^4G^\circ$?	2½ 3½ 4½ 5½	*36825.97* *38679.05* *40686.42*	1853.08 2007.37	0.825 1.055 1.208
		3½	*37143.25*		
		2½	*37145.60*		1.501
		0½	*37461.46*		1.257
		1½	*37523.54*		0.973
		3½	*37561.25*		1.242
		2½	*37630.09*		1.211
		1½	*37760.67*		0.518
$5d^3\ 6s(a\ ^3H)6p$	$z\ ^4I^\circ$? ?	4½ 5½ 6½ 7½	*37942.84* *39468.63* *40911.83*	1525.79 1443.20	0.878 1.040
		3½	*38253.39*		1.112
$5d^4(a\ ^5D)6p$	$y\ ^6F^\circ$	0½ 1½ 2½ 3½ 4½ 5½	*38507.54* *39587.81* *41580.98* *43177.37* *44806.64* *45838.75*	1080.27 1993.17 1596.39 1629.27 1032.11	0.730 1.083 1.366 1.356 1.417 1.280
		1½	*38545.70*		1.359
		2½	*38753.75*		0.952
		0½	*38845.25*		0.460
		1½	*38994.33*		1.027
		2½	*39059.52*		1.054
		1½	*39253.07*		1.128
		4½	*39422.40*		1.143
		0½	*39490.14*		0.560
		3½	*39526.7*		
		3½	*39641.24*		1.090
		2½	*39688.20*		0.930
		2½	*39786.52*		1.065
		3½	*39936.13*		1.295
		1½	*40230.01*		1.232
		0½	*40244.74*		1.056
		3½	*40333.03*		1.159
		1½	*40339.2*		0.956
		3½	*40755.90*		1.134
		2½	*40851.61*		1.265

Ta I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
		3½	*40981.79*		1.245
		2½	*41010.07*		1.227
$5d^3\,6s(a\,^5F)7s$	$e\,^6F$	0½	41151.26	443.57	−0.657
		1½	41594.83	906.76	0.996
		2½	42501.59	1480.84	1.250
		3½	43982.43	1654.40	1.433
		4½	45636.83	1682.74	1.411
		5½	47319.57		1.434
		0½	*41179.9*		0.434
		1½	*41197.67*		1.335
		3½	*41256.56*		1.533
		2½?	*41584.94*		
		1½	*41692.64*		1.183
		2½	*41879.23*		1.199
		0½	*41902.92*		0.745
		3½	*42017.95*		1.107
		1½	*42178.76?*		
		4½	*42247.00*		1.268
		1½	*42408.16*		1.227
		3½	*42751.72*		1.170
		1½	*42778.70*		1.321
		2½	*42844.73*		1.409
		3½	*42953.1*		1.046?
		2½	*42982.8*		1.172
		4½	*43090.28*		1.222
		1½	*43167.07*		1.135
		5½	*43185.09*		1.219
		2½	*43239.22*		0.973
		4½	*43391.71*		
$5d^4(a\,^5D)6p$	$y\,^4P^\circ$	0½	*43478.20*	1211.11	2.18
		1½	*44689.31*	1634.00	1.809
		2½	*46323.31*		1.601
		4½	43493.24?		
		2½	*43496.65*		1.22
		3½	*43533.3*		1.215
		2½	*43550.78*		0.945
		1½	*43818.63*		1.642
		2½	*43880.84*		1.284
$5d^3\,6s(a\,^5F)7s$	$e\,^4F$	1½	43964.50	497.10	
		2½	44461.60	3355.56	0.988
		3½	47817.16	2692.5	
		4½	50509.7		
		1½	44095.95		
		5½	*44141.31*		1.122

Ta I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
		0½	*44146.16*		0.714
		3½	*44165.58*		1.067
		4½	*44173.62*		1.115
		1½	*44350.19*		1.309
		2½	*44386.40*		1.179
		4½	*44402.56*		1.146
		1½	*44483.96*		1.034
$5d^4(a\,^5D)6p$	$z\,^6D^\circ$	0½	*44518.10*	728.12	2.378
		1½	*45246.22*	9.76	1.85
		2½	*45255.*[illegible]	1153.81	1.662
		3½	*46409.79*	1390.02	1.532
		4½	*47799.81*		
		3½	*44669.23*		1.682
		3½	*44693.40*		1.227
		5½	*45057.34*		1.056
		3½	*45114.71*		1.337
$5d^4(a\,^5D)6p$	$y\,^6P^\circ$	1½	*45241.73*	472.95	1.245
		2½	*45714.68*	1907.20	
		3½	*47621.88*		
		1½	*45276.39*		
		3½	*45648.26*		1.264
		1½	*45725.58*		1.112
		3½	*45841.6*		
		3½?	*46060.6*		
		2½	*46116.93*		1.254
		3½	*46172.44*		1.186
		1½	*46176.76*		0.896
		5½	*46552.13*		1.266
		1½	*46887.79*		0.737
		2½	*46933.38*		
		1½	*46974.03*		1.871
		2½	46981.89		
		3½	*47013.02*		
		5½	*47339.48*		
		2½	*47397.06*		
		3½	*47625.01*		
		3½	*47931.16*		
		3½	*48069.61*		
		2½	48290.45		
		2½	*48369.35*		
		4½	*48468.96*		
		4½	*49149.30*		

Ta I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
		$3\frac{1}{2}$	*49551.07*		
		$3\frac{1}{2}$	*49599.21*		
		$3\frac{1}{2}$	*49882.57*		
		$2\frac{1}{2}$	*49981.32*		
		$4\frac{1}{2}$	*50014.07*		
		$1\frac{1}{2}$	*50145.55*		
		$4\frac{1}{2}$	*50439.3*		
		$1\frac{1}{2}$	*50877.75*		
		$3\frac{1}{2}$	*51418.1*		
		$3\frac{1}{2}$	*51982.5*		
		$4\frac{1}{2}$	52723.73		
		$1\frac{1}{2}$	*52907.8*		

Ta I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$5d^3\,6s(a\,^5F)8s$	$f\,^4F$	$1\frac{1}{2}$ $2\frac{1}{2}$ $3\frac{1}{2}$ $4\frac{1}{2}$	54440.57		0.502
		$2\frac{1}{2}$	54481.09		
		$4\frac{1}{2}$	55232.59		
		$2\frac{1}{2}$	56050.2		
		$1\frac{1}{2}$	58391.76		
		$1\frac{1}{2}$	*58583.88*		
		$0\frac{1}{2}$	61551.17		
		$2\frac{1}{2}$	61737.0		
		$1\frac{1}{2}$	61789.26		
Ta II ($^5F_1$)	*Limit*		63600		

July 1957.

Ta I Observed Terms*

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,4f^{14}\,5s^2\,5p^6+$	Observed Terms	
$5d^3\,6s^2$	$a\,^4P$, $a\,^4F$ $a\,^2P$, $a\,^2D$, $a\,^2F$, $a\,^2G$, $a\,^2H$	
$5d^5$	$a\,^6S$	
	ns ($n \geq 6$)	np ($n \geq 6$)
$5d^3\,6s(a\,^5F)nx$	$e\,^6F$ $e, f\,^4F$	$z\,^6D^\circ$ $z\,^6F^\circ$ $z\,^6G^\circ$ $y\,^4D^\circ$ $z\,^4F^\circ$
$5d^3\,6s^2(a\,^4F)nx$		$z\,^4D^\circ$
$5d^3\,6s^2(a\,^4P)nx$		$z\,^4P^\circ$ $z\,^2S^\circ$ $z\,^2P^\circ$ $z\,^2D^\circ$
$5d^3\,6s(a\,^5P)nx$		$z\,^6P^\circ$ $y\,^6D^\circ$ $z\,^4S^\circ$
$5d^3\,6s(a\,^3G)nx$		$y\,^4F^\circ$ $y\,^4G^\circ$
$5d^4(a\,^5D)nx$	$a\,^6D$ $a\,^4D$	$y\,^6P^\circ$ $x\,^6D^\circ$ y [illegible] $y\,^4P^\circ$
$5d^3\,6s(a\,^3H)nx$		$z\,^4G^\circ$ $z\,^4H^\circ$ $z\,^4I^\circ$
$5d^4(b\,^3H)nx$	$a\,^4H$	
$5d^4(b\,^3G)nx$	$a\,^4G$	
$5d^4(^3F)nx$	$b\,^4F$	

*For predicted terms of the Ta I isoelectronic sequence, see Vol. III, Introduction.

Ta II

(Hf I sequence; 72 electrons) $Z=73$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^3\ 6s\ {}^5F_1$

$a\ {}^5F_1$ K I. P. volts

A preliminary list of 115 levels and g-values for Ta II was published in 1950; seven more levels were added in 1951. The present analysis is by Kiess, who has revised and greatly extended the early work especially for inclusion here. His observations range from 2000 A to 5300 A and include some 2400 lines, of which about 1000 are classified. Observed intersystem combinations connect the systems of terms having different multiplicity.

The three-place g-values in the table are from Zeeman spectrograms taken at the Massachusetts Institute of Technology; two-place values are from Bureau spectrograms.

In his recent work Kiess has greatly benefited by the theoretical investigations of Trees. In particular, one level at 16424 K listed in the 1950 paper has been rejected, and one at 23294 K has been assigned a revised J-value, on the basis of Trees' work.

No series are known for Ta II. From a study of screening constants Finkelnburg and Humbach interpolate an ionization potential of 16.2 ± 0.5 volts. This places the limit near 130700 K.

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Ta II

Config.	Desig.	J	Level	Interval	Obs. g
$5d^3(^4F)6s$	$a\ ^5F$	1	0.00	1031.33	0.000
		2	1031.33	1610.86	1.008
		3	2642.19	1773.51	1.250
		4	4415.70	1771.02	1.350
		5	6186.72		1.33
$5d^2\ 6s^2$	$a\ ^3F$	2	3180.04	3651.31	0.750
		3	6831.35	2914.98	1.098
		4	9746.33		1.225
$5d^2\ 6s^2$	$a\ ^3P$	0	4124.77	1205.89	0.000
		1	5330.66	327.34	1.550
		2	5658.00		1.340
$5d^3(^4F)6s$	$b\ ^3F$	2	9690.46	4890.54	1.063
		3	14581.00	3912.67	1.004
		4	18493.67		1.23
$5d^3(^4P)6s$	$a\ ^5P$	1	10713.30	1162.16	2.374
		2	11875.46	560.39	1.48
		3	12435.85		1.614
$5d^3(^2G)6s$	$a\ ^3G$	3	11767.14	938.18	0.915
		4	12705.32	125.62	1.021
		5	12830.94		1.280
$5d^4$	$a\ ^5D$	0	12600.37	874.53	0.000
		1	13475.40	1019.50	1.510
		2	14494.90	1231.16	1.472
		3	15726.06	1505.16	1.476
		4	17231.22		1.23
$5d^2\ 6s^2$	$a\ ^1D$	2	13560.25		1.111
$5d^2\ 6s^2$	$a\ ^1G$	4	14205.53		
$5d^3(^2D)6s$	$a\ ^3D$	1	14627.75	2540.75	0.850
		2	17168.50	1385.33	1.211
		3	18553.83		1.33
$5d^3(^2H)6s$	$a\ ^3H$	4	15851.12		1.16
		5			
		6			
$5d^3(^4P)6s$	$b\ ^3P$	0			
		1	17375.11	1125.49	1.171
		2	18500.60		1.462
$5d^3(^2F)6s$	$c\ ^3F$	2	22928.62	691.74	0.700
		3	23620.36	−537.66	1.076
		4	23082.70		1.026
$5d^3(^2D)6s$	$b\ ^1D$	2	23294.70		1.120
$5d^3(^2P)6s$	$c\ ^3P$	0	23381.19		0.000
		1			
		2			
$5d^3(^2P)6s$	$a\ ^1P$	1	23406.14		1.15
$5d^4$	$b\ ^3H$	4	24432.78	981.17	0.978
		5	25413.95		1.052
		6			
$5d^3(^2F)6s$	$a\ ^1F$	3	24869.61		0.995

Ta II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$5d^4$	$b\ ^3G$	3	26829.09		0.855
		4			
		5			
		2	29256.87		0.522
		1	33706.50		0.291
		2	33715.15		0.800
		3	36112.97		
		2	36177.12		0.947
		3	36763.73		1.169
		1	36987.73		0.685
	$^5G^\circ$	2	37230.80		0.64
	$^5F^\circ$	2	38515.55		1.026
	$^5F^\circ$	1	38535.26		0.472
	$^5G^\circ$	3	38962.38		1.001
	$^5F^\circ$	3	39295.83		1.140
	$^5G^\circ$	4	39743.64		1.222
		0	40023.76		
		2	40233.53		1.158
		1	40304.78		1.232
		2	41145.00		1.161
		1	41355.06		1.893
		3	41554.52		1.204
		5	41709.02		
		4	41775.29		0.72
	$^5F^\circ$	4	42122.91		1.265
		2	42153.32		1.210
		3	42959.59		1.117
		2	43064.95		1.061
		3	43544.44		1.086
		1	43553.87		1.50
		4	44005.16		
		1	44206.19		0.255
		2	44259.20		1.251
		3	44430.38		0.950
	$^5D^\circ$	0	44434.70		0.00
	$^5F^\circ$	5	44585.33		1.245
		4	44626.00		1.264
		3	44835.23		1.34
	$^5D^\circ$	1	45233.85		1.461
		2	45446.91		1.150
		1	46174.63		1.361
		4	46286.97		1.405

Ta II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
		5	46295.07		
	$^5D^\circ$	2	46387.28		1.31
		4	46645.81		1.210
		3	46831.39		1.204
		2	46850.69		1.097
		3	47169.18		1.093
		4	47280.92		1.198
		2	47514.61		1.292
		1	47596.02		
		0	47800.95		
		3	47825.41		1.198
		0	48064.50		
		2	48166.44		
		2	48223.11		1.448
		4	48470.35		1.268
		2	48666.55		1.137
		1	48776.36		0.750
		3	48962.66		1.275
		2	49080.44		1.33
		3	49536.28		1.318
		2	49592.90		1.63
		3	49646.60		1.045
		1	49887.03		2.023
		4	49937.82		
		3	51073.88		1.156
		2	51197.32		1.363
		1	51326.37		1.052
		2	51534.21		1.317
		3	52121.22		1.088
		1	52155.76		1.618
		3	52580.41		1.403
		1	52824.53		0.930
		3	53465.72		1.226
		2	53644.82		1.339
		2	54533.78		1.035
		3	54648.81		0.935
		3	55128.36		1.250
		3	55543.11		1.46
		2	56018.75		0.991
		4	56142.49		1.26
		4	56752.94		1.22

TUNGSTEN

W I

74 electrons $Z=74$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,4f^{14}\,5s^2\,5p^6\,5d^4\,6s^2\;{}^5D_0$

$a\,{}^6D_{\frac{1}{2}}$ 64400 K I. P. 7.98 volts

The spectrum needs further critical study. The analysis is chiefly from Laporte and Mack, who have reported 300 levels with 201 "tentative" g-values, and 2378 classified lines between 2008.64 A and 10477.97 A. Their observational material was taken mostly from the literature, supplemented by Mack's observations made at Princeton for the region short of 2500 A. The earlier work by Catalán and Poggio and by Laun was revised and extended by these authors.

Later, the spectrum was observed by Kiess at the National Bureau of Standards in the region longer than 2000 A. Short of this limit, observations were made by Boyce with the Carnegie Institution Spectrograph. Laun measured these spectrograms and prepared a complete line list extending from 1783.734 A to 7727.14 A. The earlier long-wave Bureau measurements used by Mack and Laporte are quoted in Laun's revised line list to extend the observations to 10477.97 A.

Laun has revised the published level values, changed some J-values, and added more than 50 new levels. His unpublished material has been furnished for inclusion here. The writer has tentatively retained 4 of the 16 published levels rejected by Laun. There are now approximately 3700 classified lines.

Mack and Laporte assigned a number of configurations and term designations to the known levels. Murakawa has confirmed some of the configuration assignments from a study of the isotope displacement effect, worked out from observations of the hyperfine structure of W I. He attributes some levels, also, to the $5d^3\,6s^2\,6p$ configuration.

The term and configuration assignments in the table are tentative. The writer has consulted Racah, and included some of his very provisional rearrangements of known levels, although they are far from definitive. She has also made a few other changes on the basis of the present known combinations. Observations indicate that the line at 4008.753 A ($a\,{}^7S_3 - z\,{}^7P^{\circ}_4$) is the *raie ultime*. From this evidence the $z\,{}^7P^{\circ}$ term in the table belongs predominantly to the configuration $5d^5(a\,{}^6S)6p$, instead of $5d^4\,6s(a\,{}^6D)6p$, as published. The ${}^7P^{\circ}$ term from the latter configuration is apparently not yet known.

Mack feels that grouping of levels into terms is not justifiable in W I because of the departure from LS-coupling. The writer has, however, retained the arrangement by terms among lower levels, in spite of considerable overlapping. This plan conforms to the general format of these Volumes and facilitates a ready comparison of the relative positions of the terms, the term intervals, and the observed g-values among similar spectra. She urges the users to bear in mind the reservations regarding this format that are described in the 1943 paper, and to consult this paper for further details.

The observed g-values are quoted from the 1943 paper by Laporte and Mack, pending further study of Zeeman spectrograms taken at the Massachusetts Institute of Technology. There are more than 50 given only to tenths; these are urgently in need of revision based on present observations.

The limit is from Laporte and Mack. It is derived by a Rydberg formula from the $5d^4\,6s({}^6D)ns\;{}^5D_0$ series ($n=6,7$) corrected by -2.8 percent. This Ritz correction from other spectra may need further revision when more series are known for neighboring spectra.

W I—Continued

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W I

Config.	Desig.	J	Level	Interval	Obs. g
$5d^4\,6s^2$	$a\,^5D$	0	0.00		0/0
		1	1670.30	1670.30	1.51
		2	3325.53	1655.23	1.48
		3	4830.00	1504.47	1.50
		4	6219.33	1389.33	1.49
$5d^5(a\,^6S)6s$	$a\,^7S$	3	2951.29		1.98
$5d^4\,6s^2$	$a\,^3P$	0	9528.07		0/0
		1	13307.06	3778.99	1.32
		2	19253.58	5946.52	1.18
$5d^4\,6s^2$	$a\,^3H$	4	12161.95		0.99
		5	15069.94	2907.99	1.05
		6	17008.50	1938.56	1.4
$5d^4\,6s^2$	$a\,^3G$	3	13348.54		0.92
		4	16431.28	3082.74	1.02
		5	19826.04	3394.76	1.20
$5d^4\,6s^2$	$a\,^3F$	2	13777.70		1.09
		3	17701.14	3923.44	1.02
		4	17107.02	−594.12	1.19
$5d^4\,6s^2$	$a\,^3D$	3	15459.99		1.17
		2	14976.21	483.78	1.06
		1	18082.80	−3106.59	0.7
$5d^5(a\,^4G)6s$	$a\,^5G$	2	18116.84		1.08
		3	18974.47	857.63	1.06
		4	19256.23	281.76	1.20
		5	19535.04	278.81	1.21
		6	19648.56	113.52	1.32
$5d^5(a\,^6S)6s$	$a\,^5S$	2	18280.48		1.43
$5d^4\,6s(a\,^6D)6p$	$z\,^7F^\circ$	0	*19389.43*		0/0
		1	*20064.30*	674.87	1.54
		2	*21448.76*	1384.46	1.48
		3	*23047.31*	1598.55	1.53
		4	*24763.39*	1716.08	1.50
		5	*26676.48*	1913.09	1.46
		6	*29643.06*?	2966.58?	
	$a\,^5P$?	3	19827.67		1.28
		2	20983.06	−1155.39	
		1	20427.81	555.25	2.1
		0	20174.28		
$5d^4\,6s(a\,^6D)6p$	$z\,^7D^\circ$	1	*21453.90*		2.51
		2	*23964.67*	2510.77	1.93
		3	*26189.20*	2224.53	1.80
		4	*28797.24*	2608.04	1.61
		5	*29773.34*	976.10	1.55
	^5D?	4	22476.68		1.48
		0	22773.84		
	^5F?	5	22852.84		1.2
	^5D?	3	23930.10		1.4

W I

Config.	Desig.	J	Level	Interval	Obs. g
$5d^4\,6s(a\,^6D)6p$	$z\,^5F^\circ$	1	*25983.60*		0.54
		2	*27662.52*	1678.92	1.21
		3	*29139.11*	1476.59	1.06
		4	*31432.91*	2293.80	1.32
		5	*33370.03*	1937.12	1.39
$5d^5(a\,^6S)6p$	$z\,^7P^\circ$	2	*26229.77*		1.84
		3	*27488.11*	1258.34	1.72
		4	*27889.68*	401.57	1.71
		2	*26367.28*		0.87
$5d^4\,6s(a\,^6D)6p$	$z\,^5D^\circ$	0	*26629.46*		0/0
		1	*27778.50*	1149.04	1.25
		2	*29195.84*	1417.34	1.28
		3	*29912.85*	717.01	1.31
		4	*32828.12*	2915.27	1.7
		5	27849.84		
$5d^4\,6s(a\,^6D)6p$	$z\,^5P^\circ$	1	*28198.90*		
		2	*29393.40*	1194.50	1.83
		3	*30586.64*	1193.24	1.64
		5	28233.44		
		6	28392.72		
		1	*30683.52*		1.39
		1	*31325.42*		0.86
		2	*31817.63*		1.52
		3	*32238.02*		1.3
		0	*32386.51*		
		3	*32957.58*		1.43
		2	*33141.38*		1.51
		2	*33944.06*		
		4	*34121.63*		1.5
		3	*34228.60*		
		1	*34342.41*		1.56
		3	*34354.08*		0.71
		2	*34485.86*		0.82
		4	*34632.58*		0.89
		1	*34719.33*		0.15
		4	*35116.78*		1.2
		2	*35311.54*		1.0
		3	*35499.15*		1.0

W I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
		2	35731.94		1.5
		3	35943.17		1.4
		4	36062.28		1.24
		1	36190.46		1.62
		5	36275.10		1.27
		0	36588.29		
		2	36673.70		1.50
		3	36874.86		1.50
		2	36904.14		1.57
		4	37146.34		1.1
		5	37309.18		1.25
		2	37466.30		1.28
		3	37674.08		1.13
		1	37773.96		
		4	38001.12		1.1
		3	38053.06		1.11
		6	38203.12		
		3	38206.38		
		4	38259.40		
		1	38355.81		
		0	38576.14		
		4	38748.44		
		2	39030.25		
		1	39183.20		1.01
		5	39381.01		1.13
		5	39614.05		1.20
		1	39636.62		1.44
		3	39646.41		1.46
		2	39707.02		1.00
		4	39719.96		1.17
		2	40011.50		1.0
		4	40233.97		1.53
		3	40269.35		1.03
		1	40411.12		1.58
		5	40476.42		1.04
		4	40583.07		
		3	40665.85		0.96
		1	40770.78		1.28
		2	40868.39		1.26
		5	40911.97		1.03
		3	40928.88		1.32
		2	41104.52		1.5
		0	41127.32		0/0
		6	41171.44		
		4	41198.16		1.22
		6	41417.48		1.23
		3	41490.43		1.11
		2	41583.19		1.06
		3	41694.34		1.28
		2	41734.13		1.1
		4	41871.94		1.11
		0	41965.21		
		2	41978.61		0.8
		6	42239.04		
		3	42251.51		1.32
		1	42262.30		1.5
		2	42449.60		
		4	42450.24		
		3	42514.14		1.22
		1	42573.47		1.3
		3	42601.19		1.12
		5	42866.00		1.11
		4	42910.74		1.18
		5	43034.10		
		0	43053.86		0/0
		1	43217.32		1.3
		2	43227.66		1.3
		4	43251.00		1.14
		7	43411.50		1.20
$5d^4 6s(a\ ^6D)7s$	$e\ ^7D$	1	43451.98		2.83
		2	44919.84	1467.86	1.9
		3	46496.62	1576.78	1.74
		4	47975.54	1478.92	1.68
		5	49354.68	1379.14	1.7
		3	43478.58		1.3
		2	43514.67		0.9
		4	43720.87		
		5	43741.37		1.09
		3	43850.84		1.17
		1	43892.63		1.05
		5	43924.25		1.2
		2	43975.22		1.15
		4	43985.41		1.24
		3	44021.00		1.2

W I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
		1	44353.42		1.02
		2	44367.50		1.1
		6	44390.42		1.28
		3	44447.02		1.38
		5	44546.76		1.3
		2	44596.28		1.11
		1	44737.21		1.1
		6	44923.90		1.23
		4	44940.57		1.20
		7	44970.72		1.20
		3	45014.54		1.3
		2	45019.02		
		4	45116.77		1.2
$5d^4\ 6s(a\ ^6D)7s$	$e\ ^5D$	0	45225.22		0/0
		1	46458.30	1233.08	
		2	48078.32	1620.02	1.55
		3	49656.04	1577.72	1.66
		4	51123.14	1467.10	1.4
		4	45262.55		1.1
		1	45373.99		
		2	45422.27		0.63
		5	45451.63		1.16
		3	45551.32		1.30
		3	45677.69		1.24
		1	45760.80		
		5	45789.14		1.19
		4	45869.10		1.36
		2	45902.48		0.5
		3	46068.02		1.46
		1	46104.64		
		6	46106.21		
		1	46291.66		
		2	46327.75		0.8
		3	46385.46		1.4
		5	46506.37		1.38
		4	46625.05		1.14
		6	46672.21		1.18
		2	46806.45		1.1
		5	46854.80		1.21
		4	46981.84		1.0
		2	47079.40		1.3
		1	47255.55		
		2	47337.79		0.9
		4	47360.19		
		3	47361.77		1.3
		2	47442.53		
		3	47483.70		1.29
		6	47541.55		1.23
		3	47593.44		1.2
		4	47689.33		1.4
		5	47850.86		
		4	47968.62		1.23
		5	48138.39		1.2
		3	48170.67		
		2	48244.29		1.4
		7	48250.70		
		2	48318.85		1.4
		3	48326.43		
		1	48389.96		
		4	48676.08		1.20
		6	48684.68		
		1	48788.10		
		3	49072.14		1.26
		4	49147.95		
		2	49151.94		
		5	49187.92		1.25
		2	49270.16		
		3	49417.93		
		1	49443.68		
		3	49514.34		1.3
		2	49517.26		
		4	49636.57		
		2	49699.57		1.9
		4	49788.58		
		0	49798.44		
		3	49966.03		
		5	50137.55		1.11
		3	50185.70		
		4	50284.68		1.03
		6	50429.18?		
		2	50494.54		
		1	50533.54		
		2	50718.90		
		3	50800.44		1.0

W I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
		5	50806.07		
		4	50894.09		
		4	50909.47		1.2
		1	50949.07		
		6	50951.90		
		3	51072.18		
		2	51182.41		
		5	51290.75		
		3	51600.53		
		2	51606.80		
		2	51693.85		
		1	51763.44		
		4	51856.10		
		6	51978.68		
		3	52015.28		
		4	52059.78		
		2	52064.02		
		5	52081.09		
		2	52152.62		
		2	52183.20		
		3	52255.80		
		2	52284.76		
		5	52395.52		
		4	52436.44		
		2	52503.41		
		5	52774.14		
		6	52855.98		
		3	52943.48		
		4	52992.69		
		1	53042.02		
		4	53118.29		
		5	53194.25		1.3
		6	53232.40		
		4	53238.41		
		3	53345.53		
		3	53390.42		
		2	53669.82		
		1	53847.77		
		4	53848.69		
		5	53862.72		
		2	53959.28		

W I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
		4	54118.78		
		5	54310.30		
		1	54419.65		
		3	54556.43		
		6	54733.38		
		2	54859.15		
		6	54895.96		
		4	54911.61		
		1	54941.01		
		5	55009.23		
		2	55032.67		
		4	55043.34		
		2	55084.01		
		4	55333.12		1.45
		3	55389.30		
		5	55455.32		
		5	55492.22		
		3	55546.06		
		2	55619.65		
		7	55690.82		
		5	55795.48		
		2	55835.14		
		1	55859.35		
		4	55867.24		
		4	55955.36		
		5	55987.90		
		3	56108.52		
		4	56174.63		
		4	56255.65		
		5	56280.48		
		3	56484.33		
		4	56502.10		
		6	56526.61		
		5	56573.54		
		3	56717.16		
		4	56831.67		
		6	56832.90		
		5	57143.48		
		6	57148.92		
		5	57560.81		
		6	57702.30		

W I—Continued

Config.	Desig.	J	Level	Interval	Obs. g	Config.	Desig.	J	Level	Interval	Obs. g
		4	*57803.661?*					5	*59263.63*		
		6	*57919.17*					6	*59410.53*		
		3	*58091.56*					2	*59422.00*		
		5	*58179.39*					5	*59673.32*		
		3	*58206.03*					2	*59999.12*		
		5	*58562.70*					4	*60385.09*		
		3	*58644.10*					5	*60741.46*		
		4	*58777.80*					5	*62154.50*		
		5	*58903.98*			----------------	---------	---	----------		
		6	*59128.82*			W II($^6D_{1/2}$)	*Limit*	---	64400		
		4	*59171.71*								

March 1956.

W I Observed Terms*

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}$ $4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6+$	Observed Terms	
$5d^4\ 6s^2$	$a\ ^3P$ $a\ ^5D$, $a\ ^3D$ $a\ ^3F$ $a\ ^3G$ $a\ ^3H$	
	$ns\ (n \geq 6)$	$np\ (n \geq 6)$
$5d^5(a\ ^6S)nx$	$a\ ^7S$, $a\ ^5S$	$z\ ^7P^\circ$
$5d^5(a\ ^4G)nx$	$a\ ^5G$	
$5d^4\ 6s(a\ ^6D)nx$	$e\ ^7D$, $e\ ^5D$	$z\ ^5P^\circ$ $z\ ^7D^\circ$, $z\ ^5D^\circ$ $z\ ^7F^\circ$, $z\ ^5F^\circ$

*For predicted terms in the spectra of the W I isoelectronic sequence, see Vol. III, Introduction.

W II

(Ta I sequence; 73 electrons) $Z=74$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^4\ 6s\ ^6D_{1/2}$

$a\ ^6D_{1/2}$ K I. P. volts

In 1938 a preliminary analysis was published by Laun. Later Kiess reobserved the spectrum and Zeeman effect, at the National Bureau of Standards, in the region longer than 2000 A. Short of 2000 A, observations were made by Boyce with the Carnegie Spectrograph. Laun has measured these spectrograms and extended his earlier analysis especially for inclusion here. There are more than 1,250 classified lines between 1756.684 A and 6219.77 A.

Mack and Mrs. Taschek have added seven new levels and the three-place g-values listed in the table. Their Zeeman data have been taken from observations made with the Bitter magnet, at the Massachusetts Institute of Technology.

W II—Continued

The authors have a decided preference for arrangement by levels throughout the spectrum because the departure from *LS*-coupling makes it difficult to assign term designations except for the lowest terms. The writer has retained the listing by terms for the lower levels in conformance with the general format adopted for these Volumes. A ready comparison of term intervals and observed *g*-values can thus be made with similar spectra.

The higher levels are listed in increasing numerical order. By analogy with Mo II, and from an examination of the observed *g*-values, Kiess and the writer have assigned tentative designations to a number of these miscellaneous levels. These should be confirmed by further study. They are consistent with theoretical calculations made by Trees.

No series have been detected in W II. From a study of screening constants, Finkelnburg and Humbach interpolate an ionization potential of 17.7±0.5 volts.

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J. E. Mack and I. M. Taschek, unpublished material (April 1956). (T) (Z E)

W II

Config.	Desig.	*J*	Level	Interval	Obs. *g*
$5d^4(^5D)6s$	$a\ ^6D$	0½	0.00		3.186
		1½	1518.78	1518.78	1.839
		2½	3172.52	1653.74	1.639
		3½	4716.32	1543.80	1.563
		4½	6147.16	1430.84	1.522
$5d^5$	$a\ ^6S$	2½	7420.43		1.913
$5d^4(^3F)6s$	$a\ ^4F$	1½	8711.26		0.624
		2½	11301.08	2589.82	1.084
		3½	13411.96	2110.88	1.186
		4½	14857.22	1445.26	1.234
$5d^4(^3P)6s$	$a\ ^4P$	0½	8832.66		2.383
		1½	10592.52	1759.86	1.471
		2½	13434.10	2841.58	1.526
$5d^4(^5D)6s$	$a\ ^4D$	0½	13173.38		0.455
		1½	14634.36	1460.98	1.183
		2½	14967.82	333.46	1.013
		3½	15147.02	179.20	0.872
$5d^4(^3G)6s$	$a\ ^4G$	2½	16234.84		0.995
		3½	16589.67	354.83	1.153
		4½	16553.14	−36.53	1.137
		5½	17437.02	883.88	1.181
$5d^4(^3H)6s$	^4H	3½	18000.70		1.098
$5d^5$	^2D	1½	18990.96		0.90
$5d^5$	^4G	4½	19070.68		1.102
$5d^5$	^4G	2½	19276.52		0.997
$5d^4(^3P)6s$	^2P	0½	19404.08		0.64
$5d^4(^3H)6s$	^4H	6½	19442.54		
$5d^5$	^2D	2½	19637.38		1.102
$5d^5$	^4G	3½	20039.74		1.117
$5d^5$	^4D	1½	20455.93		
$5d^5$	^4G	5½	20534.35		1.197
$5d^4(^3H)6s$	^4H	4½	20780.38		1.065
$5d^5$	^4F	2½	22139.97		1.06
$5d^5$	^4F	3½	22194.08		1.119
$5d^4(^3P)6s$	^2P	1½	22503.06		1.22
$5d^4(^3D)6s$	^4D	3½	23046.80		
$5d^5$	^4F	4½	23234.87		1.249
$5d^5$	^4D	2½	23450.50		1.297
$5d^5$	^4D	3½	23803.84		
$5d^5$	^2I	5½	23955.40		1.10
$5d^5$	^4F	1½	24991.56		
$5d^5$	^4P	1½	25169.87		1.64
$5d^4(^3H)6s$	^2H	4½	26158.74		
$5d^5$	^4P	2½	26227.00		
$5d^4(^3H)6s$	^2H	5½	26929.34		
$5d^4(^5D)6p$	$^6F^\circ$	0½	*36165.35*		0.678
$5d^4(^3P)6p$	$^2S^\circ$	0½	*38576.32*		1.614
$5d^4(^5D)6p$	$^6F^\circ$	1½	*39129.41*		1.147
		2½	*39936.81*		0.889
$5d^4(^5D)6p$	$^6F^\circ$	2½	*42049.45*		1.292
		1½	*42298.20*		1.498
		3½	*42390.27*		1.161
		2½	*44354.82*		1.390
		0½	*44455.18*		−0.217
		4½	*44758.10*		1.270
$5d^4(^5D)6p$	$^4F^\circ$	3½	*44877.18*		1.277
		1½	*44911.63*		1.221
		0½	*45457.02*		0.519

W II—Continued

Config.	Desig.	J	Level	Interval	Obs. g	Config.	Desig.	J	Level	Interval	Obs. g
		1½	45553.70		1.033			2½	54375.82		
		3½	46175.42		1.452			0½	54408.60		
		2½	46355.40		1.236			3½	54498.57		
5d⁴(⁵D)6p	⁶F°	4½	46493.43		1.311			2½	54704.61		0.623
		0½	46625.27			5d⁴(³H)6p	⁴H°	5½	54958.58		1.141
		1½	47179.94		1.007			2½	55162.30		
		2½	47413.33		1.111			4½	55392.37		1.061
		1½	47588.64					1½	55488.01		
		2½	48284.48		1.366			1½	56084.30		1.021
		5½	48332.73					5½	56376.45		
		3½	48830.70		1.008	5d⁴(³H)6p	⁴H°	6½	56439.58		
		1½	48982.86					3½	56612.74		1.22
		3½	49124.52		1.499			3½	56768.61		1.147
		0½	49154.50					2½	56874.99		0.815
		4½	49181.04		1.409			1½	56932.27		
		2½	49242.10		1.510			4½	57089.46		
		2½	50292.33		1.334			3½	57729.92		1.184
		1½	50430.95					2½	57856.70		1.36
		4½	50863.05		1.194			1½	58007.60		
		3½	51045.25					2½	58336.98		
		1½	51254.40		1.58			3½	58709.56		
		2½	51438.03		1.301			1½	58747.94		
5d⁴(⁵D)6p	⁴F°	5½	51495.00		1.054			5½	58891.74		1.144
		3½	51863.03		0.937			3½	59276.81		1.102
		2½	52087.02					4½	59399.34		1.179
		3½	52275.28		1.297			3½	59869.14		1.125
		0½	52355.11		0.981			3½	59933.66		
		4½	52567.15					5½	60218.84		1.130
		0½	52593.72		1.14			3½	60256.45		
		3½	52901.74		1.374			4½	60278.71		
		2½	53113.52		1.262			2½	60656.51		
		1½	53329.71		1.357			4½	61055.80		
		3½	53338.07		0.968			5½	61240.81		1.120
		4½	53369.97		1.086			3½	61326.29		
		1½	53422.98		0.976			4½	61360.54		
	⁴P°?	0½	53440.17		2.038			5½	61589.46		1.149
		2½	54026.24					6½	61602.16		
		4½	54056.54		1.123			2½	62333.20		
	⁴P°?	1½	54137.20		1.608			4½	64516.37		
		5½	54289.06								

April 1956.

RHENIUM

Re I

75 electrons $Z=75$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^5\ 6s^2\ ^6S_{2\frac{1}{2}}$

$6s^2\ ^6S_{2\frac{1}{2}}$ **63530 K** I. P. 7.87 volts

The Re I spectrum furnishes one of the finest examples of international collaboration of any spectrum on the "Atomic Energy Levels" program. The present analysis represents the work of American, Dutch, and Spanish spectroscopists. Klinkenberg, Meggers, Velasco, and Catalán have completed their study of Re I especially for inclusion here.

The observational material consists of a new description of the spectrum supplied by Meggers, including some 4200 lines. This was supplemented by measurements of Velasco from spectrograms covering the vacuum region, taken by Catalán at Princeton University. The present line list extends from about 1700 A to 11788.9 A and includes 2764 classified lines arising from permitted transitions among 71 even and 211 odd levels.

The first measurements of hyperfine structure in Re I were made by Meggers. In his 1931 paper he states that about 25 percent of the 2,000 or more lines . . . show hyperfine structure of 2 to 6 components.

Observed g-values are known for 75 percent of the energy levels. These are from Zeeman spectrograms taken by Meggers at the Massachusetts Institute of Technology, through the courtesy of G. R. Harrison. The patterns were measured by Meggers, and these data were given to Catalán and Velasco who, in turn, derived the g-values.

The present interpretation is the result of all three groups, and greatly extends the earlier work on Re I by these authors. Observed intersystem combinations connect the systems of terms of different multiplicity. For a number of terms in the table the LS-designation assignments are based on theoretical work by Trees. He points out that the hyperfine structure exhibited by the $a\ ^8S$ term probably results from the influence of the $5d^6(^1S)6s\ ^2S$ term. His work is still in progress.

The limit is derived from two triplet terms, interpreted as combinations of $6p\ ^8P^\circ$ with $7s\ ^8S$ and $8s\ ^8S$, as reported in 1931. No improved series have been found from the present work.

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Re I

Config.	Desig.	J	Level	Interval	Obs. g
$5d^5 6s^2$	$a\ ^6S$	2½	0.00		1.950
$5d^5 6s^2$	$a\ ^4P$	2½	11583.96	−2242.16	1.278
		1½	13826.12	−1339.77	1.485
		0½	15165.89		2.368
$5d^6(^5D)6s$	$a\ ^6D$	4½	11754.52	−2462.34	1.545
		3½	14216.86	−1553.56	1.567
		2½	15770.42	−557.09	1.309
		1½	16327.51	−910.79	1.706
		0½	17238.30		2.521
$5d^5 6s^2$	$a\ ^4G$	2½	14621.46	436.73	1.151
		3½	15058.19	1561.09	1.153
		4½	16619.28	−312.13	1.175
		5½	16307.15		1.242
$5d^5 6s^2$	$a\ ^4D$	3½	17330.82	−2127.07	1.255
		2½	19457.89	−1023.84	1.361
		1½	20481.73	723.82	1.451
		0½	19757.91		0.983
$5d^5 6s(a\ ^7S)6p$	$z\ ^8P^\circ$	2½	*18950.1*	1497.7	2.274
		3½	*20447.8*	3184.0	1.926
		4½	*23631.82*		1.768
$5d^5 6s^2$	$a\ ^2F$	3½	21775.40	−2650.00	1.135
		2½	24425.40		1.067
$5d^5 6s^2$	$a\ ^2G$	4½	22160.04	−2564.18	1.198
		3½	24724.22		1.03
$5d^5 6s^2$	$a\ ^2D$	1½	22422.83	731.98	0.781
		2½	23154.81		1.189
$5d^5 6s^2$	$a\ ^2I$	5½	23956.00	2392.96	0.995
		6½	26348.96		1.100
$5d^5 6s^2$	$a\ ^4F$	1½	26131.57	1898.75	0.650
		2½	28030.32	511.81	1.12
		3½	28542.13	−1027.82	
		4½	27514.31		1.13
$5d^6(^3P)6s$	$b\ ^4P$	2½	26661.43	−3865.17	1.32
		1½	30526.60		
		0½			
$5d^6(^3H)6s$	$a\ ^4H$	6½	27130.14	−113.74	1.208
		5½	27243.88	82.53	1.18
		4½	27161.35	−1648.52	
		3½	28809.87		0.93
$5d^6(^5D)6s$	$b\ ^4D$	3½	27141.13	−2659.25	1.34
		2½	29800.38	1972.73	1.17
		1½	27827.65	−2303.92	0.888
		0½	30131.57		
$5d^5 6s^2$	$a\ ^2S$	0½	27384.80		
$5d^5 6s(a\ ^7S)6p$	$z\ ^6P^\circ$	3½	*28889.72*	35.54	1.709
		2½	*28854.18*	−107.38	1.871
		1½	*28961.56*		2.333
$5d^5 6s^2$	$a\ ^2H$	5½	30559.91	−839.39	1.07
		4½	31399.30		
$5d^6(^3F)6s$	$b\ ^4F$	4½	30645.33		
		3½			
		2½	31186.08	−274.54	1.17
		1½	31460.62		
$5d^5 6s^2$	$b\ ^2F$	3½	31982.99	−452.15	
		2½	32435.14		
$5d^4 6s^2(a\ ^5D)6p$	$z\ ^6D^\circ$	0½	*32443.61*	148.02	1.762
		1½	*32591.63*	817.10	1.500
		2½	*33408.73*	1111.52	1.454
		3½	*34520.25*	1402.77	1.440
		4½	*35923.02*		

Re I

Config.	Desig.	J	Level	Interval	Obs. g
$5d^6(^3G)6s$	$b\ ^4G$	2½	33281.65	542.01	
		3½	33823.66	370.61	
		4½	34194.27	−876.70	
		5½	33317.57		
$5d^4 6s^2(a\ ^5D)6p$	$y\ ^6P^\circ$	1½	*33589.12*		2.335
		2½			
		3½			
$5d^5 6s(a\ ^5S)6p$	$z\ ^4P^\circ$	2½	*35267.94*	−2647.93	1.385
		1½	*37915.87*	117.92	1.495
		0½	*37797.95*		2.620
$5d^5 6s(a\ ^5G)6p$	$z\ ^6G^\circ$	1½	*37063.65*	317.76	0.626
		2½	*37381.41*	1139.33	0.990
		3½	*38520.74*	473.99	1.216
		4½	*38994.73*	921.66	1.25
		5½	*39916.39*	576.95	1.314
		6½	*40493.34*		1.364
$5d^4 6s^2(a\ ^5D)6p$	$z\ ^6F^\circ$	0½	*37381.41*	2545.34	
		1½	*39926.75*	−861.83	0.745
		2½	*39064.92*	−1299.27	1.335
		3½	*37765.65*	1890.34	1.335
		4½	*39655.99*	−459.25	1.444
		5½	*39196.74*		1.405
		2½	*37697.66*		1.219
		2½	*39670.52*		1.107
$5d^5 6s(a\ ^5S)6p$	$x\ ^6P^\circ$	3½	*39844.75*	−3724.61	1.223
		2½	*43569.36*	−132.84	1.504
		1½	*43702.20*		1.962
		1½	*40808.85*		1.351
		0½	*40810.17*		
		2½	*40821.83*		1.126
$5d^5 6s(a\ ^5P)6p$	$y\ ^6D^\circ$	4½			
		3½	*40946.53*	−366.49	1.534
		2½	*41313.02*	−244.06	1.278
		1½	*41557.08*		1.655
		0½			
		3½	*41163.91*		1.325
		4½	*41453.18*		1.372
		3½	*41843.85*		1.190
$5d^5 6s(a\ ^5P)6p$	$z\ ^4D^\circ$	0½	*41991.56*	262.63	0.61
		1½	*42254.19*	789.83	1.578
		2½	*43044.02*	363.85	1.449
		3½	*43407.87*		1.368
		4½	*42140.06*		1.249
$5d^5 6s(a\ ^7S)7s$	$e\ ^8S$	3½	42598.27		1.957
		1½	*43341.85*		0.975
		1½?	*43409.11*		
		4½	*43453.30*		1.336
		3½	*43815.01*		1.348
		2½	*43949.98*		1.385
		5½	*43996.30*		1.26
		2½	44054.21		
		1½	*44148.45*		1.573
		4½	*44224.58*		1.244
		2½	*44308.73*		1.223
	$^4D^\circ$	0½	*44416.33*		0.15

Re I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$5d^5\,6s(a\,^7S)7s$	$e\,^6S$	2½	44703.37		1.866
		1½	44720.09		1.330
		3½	44901.15		1.253
		2½	44902.60		
		3½	44946.12		0.905
$5d^6(^5D)6p$	$y\,^6F^\circ$	5½	45082.63	−1291.62	1.40
		4½	46374.25	−1558.30	1.341
		3½	47932.55	−1090.22	1.31
		2½	49022.77	−644.48	1.495
		1½	49667.25	−192.28	1.27
		0½	49859.53		0.410
		1½	45121.81		0.674
		2½	45332.03		1.088
		4½	45543.57		1.131
		3½	45462.83		1.300
	$^4P^\circ$	0½	45817.26		2.197
		1½	45876.34		1.384
		5½	45904.25		1.175
		3½	45937.18		1.298
		2½	46112.24		1.405
		1½	46141.11		0.716
		3½	46352.99		1.271
		2½	46509.40		1.371
		2½	46649.42		1.334
		1½	46733.38		1.858
		1½	47004.34		1.285
		2½	47101.61		0.893
		1½	47172.1		
		0½	47172.9		2.215
		4½	47205.73		1.106
		3½	47358.36		1.151
		6½	47506.79		1.26
		0½	47664.74		1.50
		3½	47669.01		1.196
		1½	47703.78		1.443
		1½	47779.91		1.362
		5½	47859.93		1.20
		2½	47899.22		1.217
		2½	47970.82		1.169
		3½	48184.90		1.252
		5½	48569.63		1.27
		3½	48786.35		1.53
		3½	48857.60		1.24
		3½	49027.85		1.499
		4½	49170.76		1.135

Re I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
		1½	49250.02		1.263
		5½	49286.07		1.075
		2½	49540.96		
		2½	49573.11		1.344
		4½	49582.61		1.058
		3½	49863.22		1.175
		1½	49895.57		1.989
		2½	50110.28		1.765
		2½	50158.87		1.422
		4½	50196.94		1.345
		1½	50263.22		1.234
		3½	50310.70		1.170
$5d^5\,6s(a\,^7S)6d$	$e\,^8D$	1½	50332.60	8.02	
		2½	50340.62	18.61	2.027
		3½	50359.23	36.49	1.820
		4½	50395.72	68.62	1.690
		5½	50464.34		1.629
		4½	50401.01		1.055
		2½	50463.80		1.144
		1½	50571.02		0.935
		5½	50663.51		1.220
		3½	50869.00		1.240
		2½	50934.18		1.385
		2½	50973.17		1.489
$5d^5\,6s(a\,^7S)6d$	$e\,^6D$	4½	50994.15	5.68	1.548
		3½	50988.47	−47.09	1.558
		2½	51035.56	4.83	1.546
		1½	51030.73	−19.14	
		0½	51049.87		
		4½	51027.96		
		1½	51183.00		1.456
		4½	51193.49		
		3½	51229.64		1.231
		2½	51477.15		0.97
		4½	51486.29		1.20
		1½	51578.05		0.92
		2½	51590.08		1.02
		3½	51647.82		1.139
		1½	51874.43		1.29
		5½	51945.94		
		3½	51955.02		1.200
		4½	52001.37		1.357
		6½	52122.35		1.17
		2½	52218.11		1.208
		6½	52227.20		
		1½	52278.28		1.422
		3½	52373.12		

Re I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
		0½	*52469.45*		1.315
		2½	*52472.31*		
		3½	*52610.01*		
		4½	*52741.30*		
		3½	*52857.44*		1.30
		2½	*52881.34*		1.05
		1½	*52951.59*		1.14
		1½	*52954.46*		
		2½	*53058.74*		1.184
		0½	*53125.19*		1.145
		0½	*53288.28*		1.372
		1½	*53293.72*		1.323
		4½	*53320.95*		1.38
		3½	*53335.94*		1.290
		4½	*53379.35*		1.09
		2½	*53389.73*		1.19
$5d^5 6s(a\ ^7S)8s$	$f\ ^8S$	3½	53392.00		
		5½	*53467.57*		1.20
		3½	*53738.46*		1.203
		1½	*53842.53*		1.169
		0½	*53928.90*		1.113
		5½	*53948.73*		1.13
		3½	*54018.19*		0.723
		3½	*54086.69*		1.22
		3½	*54177.25*		1.270
		2½	*54268.18*		1.290
		2½	*54409.61*		1.069
		1½	*54467.40*		1.361
		3½	*54513.84*		
		5½	*54554.61*		
		6½	*54729.52*		
		4½	*54813.12*		1.185
		2½	*54823.02*		1.183
		0½	*54968.85*		1.314
		5½	*55223.85*		1.149
		3½	*55454.48*		1.17
		6½	*55776.51*		1.056
		3½	*55901.20*		1.22
		1½	*55902.01*		0.447
		4½	*55912.42*		1.06
		4½	*56307.97*		

Re I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
		4½	*56411.22*		
		0½	*56451.87*		1.287
		6½	*56523.41*		
		3½	*56699.41*		1.25
		2½	*56822.75*		
		1½	*56866.06*		0.479
		0½	*57073.31*		0.94
		3½	*57090.29*		
		3½	*57172.70*		1.19
		4½	*57280.86*		1.19
		3½	*57371.75*		
		5½	*57391.44*		1.30
		6½	*57452.83*		
		2½	*57524.31*		1.40
		4½	*57656.85*		1.19
$5d^4 6s^2(a\ ^5D)7s$	$f\ ^6D$	0½			
		1½	57665.43		
		2½	59268.79	1603.36	
		3½	58060.64	−1208.15	
		4½	58368.90	308.26	
		1½	*58050.58*		1.111
		3½	*58260.03*		1.43
		4½	*58279.31*		
		2½	*58332.42*		
		1½	*58442.51*		1.32
		0½	*58541.88*		
		5½	*58619.32*		1.165
		1½	*59127.30*		1.20
		2½	*59171.73*		
		1½	*59293.45*		
		4½	*59394.29*		
		5½	*59412.46*		1.15
		3½	*59784.67*		
		3½	*59926.91*		1.100
		2½	*60737.28*		
		2½	*60837.10*		1.22
		5½	*62142.97*		
		3½	*62350.13*		
		3½	*62493.51*		1.17
		5½	*63267.63*		1.135
Re II($^7S_3$)	*Limit*	-----	63530		
		6½	*63772.40*		
		6½	*63934.76*		1.07

Re I Observed Terms*

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}$ $4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6+$	Observed Terms		
$5d^5\ 6s^2$	$a\ ^6S$ $a\ ^4P$ $a\ ^4D$ $a\ ^4F$ $a\ ^4G$ $a\ ^2S$ $a\ ^2D$ $a\ ^2F$ $a\ ^2G$ $a\ ^2H$ $a\ ^2I$ $b\ ^2F$		
	$ns\ (n\geq 6)$	$np\ (n\geq 6)$	$nd\ (n\geq 6)$
$5d^5\ 6s(a\ ^7S)ns$	$e, f\ ^8S$ $e\ ^6S$	$z\ ^8P^\circ$ $z\ ^6P^\circ$	$e\ ^8D$ $e\ ^6D$
$5d^6(^5D)ns$	$a\ ^6D$ $b\ ^4D$	$y\ ^6F^\circ$	
$5d^5\ 6s(a\ ^5S)ns$		$x\ ^6P^\circ$ $z\ ^4P^\circ$	
$5d^5\ 6s(a\ ^5G)ns$		$z\ ^6G^\circ$	
$5d^5\ 6s(a\ ^5P)ns$		$y\ ^6D^\circ$ $z\ ^4D^\circ$	
$5d^6(^3P)ns$	$b\ ^4P$		
$5d^6(^3H)ns$	$a\ ^4H$		
$5d^6(^3F)ns$	$b\ ^4F$		
$5d^6(^3G)ns$	$b\ ^4G$		
$5d^4\ 6s^2(a\ ^5D)ns$	$f\ ^6D$	$y\ ^6P^\circ$ $z\ ^6D^\circ$ $z\ ^6F^\circ$	

*For predicted terms in the spectra of the Re I isoelectronic sequence, see Volume III, Introduction.

Re II

(W I sequence; 74 electrons) $Z=75$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^5\ 6s\ ^7S_3$

$6s\ ^7S_3$ K I. P. volts

In 1952, Meggers published a description of the Re II spectrum that included some 1800 lines in the range 2000.47 A to 6026.60 A. Later, Catalán extended the observations in the short-wave region to 1500 A, with the vacuum spectrograph at Princeton University; and Sales provided measurements in this region.

On the basis of this new description, the present analysis has been carried out by Meggers, Catalán, and Sales. Nine "odd" levels have also been contributed by Tech.

The observed g-values are from Zeeman spectrograms taken by Meggers with the Bitter magnet at the Massachusetts Institute of Technology, through the courtesy of G. R. Harrison.

Approximately 1000 lines are classified, but the assignment of term designations has not been attempted in many cases because of the marked departure from *LS*-coupling and the effect of configuration-interaction. The absence of the low $5d^6\ ^5D$ term is conspicuous, but persistent search has failed to reveal this term.

No series are known in Re II. From a study of screening constants Finkelnburg and Humbach have extrapolated an ionization potential of 16.6±0.5 volts, which places the limit near 133900 K.

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Re II

Config.	Desig.	J	Level	Interval	Obs. g
$5d^5(^6S)6s$	$a\ ^7S$	3	0. 0		2. 05
$5d^4\ 6s^2$	$a\ ^5D$	0	13777. 3	1046. 7	0/0
		1	14824. 0	−471. 8	1. 50
		2	14352. 2	578. 3	1. 53
		3	14930. 5	−47. 9	1. 48
		4	14882. 6		1. 48
$5d^5(^6S)6s$	$a\ ^5S$	2	17223. 5		1. 71
$5d^5(^4G)6s$	$a\ ^5G$	2	18845. 8	293. 9	0. 64
		3	19139. 7	1323. 5	1. 12
		4	20463. 2	513. 2	1. 18
		5	20976. 4	1254. 7	1. 26
		6	22031. 1		1. 24
$5d^5(^4P)6s$	$a\ ^5P$	3	21629. 1	−1711. 7	1. 26
		2	23340. 8	−381. 6	1. 67
		1	23722. 4		1. 903
		2	22544. 7		1. 20
		1	23146. 2		1. 10
		5	23381. 2		1. 19
		4	23893. 5		1. 275
		3	24763. 1		1. 41
$5d^5(^4G)6s$	$a\ ^3G$?	3	25321. 2	916. 1	0. 90
		4	26237. 3	−249. 8	1. 12
		5	25987. 5		1. 22
		1	26664. 3		1. 46
		2	26767. 6		1. 09
		3	27627. 7		
		3	27746. 0		1. 23
		4	28095. 3		1. 22
		2	29077. 3		
		1	29427. 2		1. 368
		4	29638. 9		
		2	29728. 1		1. 292
		0	29773. 2		0/0
		3	30224. 8		1. 398
		3	30717. 5		1. 26
		4	30982. 5		1. 188
		2	31012. 8		1. 42
		4	32206. 5		1. 08
		3	32257. 8		1. 114
		5	32344. 7		1. 15
		2	32875. 8		1. 06
		4	32957. 3		1. 54
		4	33169. 3		1. 188
		3	33989. 8		
		2	34937. 2		1. 23
		5	36063. 5		1. 21
		3	36993. 4		
		3	37318. 5		
		2	37382. 0		1. 071

Re II

Config.	Desig.	J	Level	Interval	Obs. g
$5d^5(^6S)6p$	$z\ ^7P^\circ$	2	43937. 7	1209. 8	2. 19
		3	45147. 5	5533. 4	1. 79
		4	50680. 9		
$5d^5(^6S)6p$	$z\ ^5P^\circ$	1	49439. 3	3237. 7	2. 42
		2	52677. 0	1125. 1	1. 82
		3	53802. 1		1. 66
$5d^5(^4F)6p$	$z\ ^5D^\circ$	0	54468. 0	1904. 1	
		1	56372. 1	766. 5	1. 291
		2	57138. 6	2191. 3	1. 30
		3	59329. 9	3529. 1	1. 145
		4	62859. 0		1. 27
$5d^5(^4P)6p$	$y\ ^5P^\circ$	3			
		2	55059. 2	−91. 6	1. 81
		1	55150. 8		2. 27
$5d^5(^4F)6p$	$z\ ^5F^\circ$	1			
		2	55444. 0	1606. 2	1. 083
		3	57050. 2	2545. 9	1. 135
		4	59596. 1	4686. 2	1. 177
		5	64282. 3		1. 31
$5d^5(^4F)6p$	$z\ ^5G^\circ$?	2			
		3	57429. 4	1852. 4	1. 056
		4	59281. 8	1645. 0	1. 625
		5	60926. 8		1. 18
		6			
$5d^5(^4P)6p$	$z\ ^3P^\circ$	0			
		1			
		2	59388. 3		1. 520
		3	59665. 8		1. 19
		1	60487. 2		1. 128
		3	60525. 0		
		2	62057. 3		1. 17
		1	[illegible]7. 8		1. 52
		3	[illegible]14. 9		1. 243
		3	63043. 3		1. 34
		4	63127. 7		1. 27
		2	63464. 2		1. 50
		4	64407. 2		1. 21
		2	64411. 4		0. 812
		3	64942. 2		1. 36
		3	64966. 9		
		1	65011. 0		0. 796
		3	65572. 3		1. 28
		2	65674. 0		
		3	66100. 3		1. 40
		3	66248. 1		
		4	66371. 2		1. 38
		4	66476. 2		
		5	66514. 6		1. 18
		5	66536. 7		
		2	66730. 5		1. 274
		2	66782. 6		
		5	67049. 1		1. 29

Re II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
		1	*67276.1*		1.292
		3	*67314.0*		1.194
		4	*67398.1*		1.15
		5	*68259.5*		1.16
		3	*68354.3*		
		2	*68629.4*		
		3	*68868.0*		
		4	*68876.7*		
		3	*69142.5*		1.083
		2	*69170.0*		1.30
		4	*69283.6*		1.35
		3	*69302.8*		1.677
		3	*69729.2*		
		4	*69776.3*		1.25
		4	*69796.2*		
		1	*70137.8*		1.637
		3	*70811.0*		1.17
		1	*71088.7*		
		4	*71128.5*		1.19

Re II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
		2	*71396.8*		
		2	*71732.0*		1.40
		2	*71949.0*		
		2	*72134.8*		
		2	*72536.3*		
		3	*72846.6*		
		3	*73553.9*		
		4	*74064.4*		
		3	*74070.8*		
		2	*74323.3*		
		3	*74469.2*		
		3	*74633.0*		
		3	*75117.0*		
		2	*75237.1*		
		4	*76137.1*		
		3	*76367.2*		
		3	*77190.7*		1.11
		3	*77223.4*		
		3	*77975.9*		

December 1957.

Re II Observed Terms*

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6+$	Observed Terms	
$5d^4\ 6s^2$	a ^{5}D	
	ns ($n \geq 6$)	*np* ($n \geq 6$)
$5d^5(^6S)ns$	a ^{7}S a ^{5}S	z ^{7}P° z ^{5}P°
$5d^5(^4G)ns$	a ^{5}G a ^{3}G?	
$5d^5(^4P)ns$	a ^{5}P	y ^{5}P° z ^{3}P°
$5d^5(^4F)ns$		z ^{5}D° z ^{5}F° z ^{5}G°?

*For predicted terms in the spectra of the W I isoelectronic sequence, see Volume III, Introduction.

OSMIUM

Os I

76 electrons **$Z=76$**

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,4f^{14}\,5s^2\,5p^6\,5d^6\,6s^2\ {}^5D_4$

$a\ {}^5D_4$ 70450 K **I. P. 8.7 volts**

As early as 1900, "long before any theory of complex spectra had been developed", Snyder noted regularities among 55 Os I lines, but he never published his results. In 1934 Albertson extended the analyses to include 137 levels and more than 1050 classified lines. In 1938 he reported that he had reobserved the spectrum at the Massachusetts Institute of Technology with high dispersion and recorded more than 4500 lines, of which 2169 were classified as combinations among 234 energy levels. He derived the limit from the two-member series $6s^2\ {}^5D_4$, $7s\ {}^7D_4$ by means of a Rydberg formula.

In 1949 van den Bosch made more complete observations at the Massachusetts Institute of Technology, including Zeeman spectrograms. He has, also, had access to Albertson's unpublished material and, in collaboration with van Kleef, has extended the number of energy levels to 257, and furnished the present list in advance of publication especially for inclusion here. All the tabular g-values are from van den Bosch. His present line list covers the range 2000 A to 8645 A and includes approximately 6000 lines, of which 2387 are classified. Owing to the departure from LS-coupling and to the effect of configuration-interaction most of the levels have not been assigned LS-term designations.

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J. C. van den Bosch and Th. A. M. van Kleef, unpublished material (August 1956). (T) (C L) (Z E)

Os I

Config.	Desig.	J	Level	Interval	Obs. g
$5d^6 6s^2$	$a\ ^5D$	4	0.00	−4159.32	1.44
		3	4159.32	1418.83	1.47
		2	2740.49	−3025.65	1.44
		1	5766.14	−326.65	1.47
		0	6092.79		
$5d^7(^4F)6s$	$a\ ^5F$	5	5143.92	−3598.91	1.38
		4	8742.83	−2635.17	1.31
		3	11378.00	1212.02	1.26
		2	10165.98	−2854.09	1.45
		1	13020.07		0.31
$5d^7(^4F)6s$	$a\ ^3F$	4	11030.58	−3060.79	1.16
		3	14091.37	1316.99	1.10
		2	12774.38		1.00
		2	13364.83		0.94
$5d^6 6s^2$	$a\ ^3H$	4	14848.05	−509.06	1.08
		5	14338.99	513.34	1.13
		6	14852.33		1.14
		2	15222.57		1.61
$5d^7(^4P)6s$	$a\ ^5P$	3	15390.76		1.54
		2			
		1			
		1	16212.41		1.74
		1	17667.34		1.40
$5d^7(^4P)6s$	$a\ ^3P$	2			
		1			
		0	18301.40		
		3	18901.94		1.20
		0	19048.91		
		4	19108.87		1.03
		2	19410.66		0.97
		4	19893.07		1.06
		1	21033.45		0.88
		3	21123.66		0.94
		2	21303.36		1.26
		1	22563.65		
$5d^6 6s(a\ ^6D)6p$	$z\ ^7D^\circ$	5	*23462.90*	847.21	1.55
		4	*22615.69*	−2397.24	1.62
		3	*25012.93*	−262.49	1.73
		2	*25275.42*		2.04
		1			
		2	23317.60		1.27
		4	23322.66		1.04
		3	23984.58		1.07

Config.	Desig.	J	Level	Interval	Obs. g
		5	24291.97		
		2	25069.71		0.89
		3	25593.94		
		4	25601.55		
		2	*27954.52*		2.04
		3	28139.52		1.24
$5d^6 6s(a\ ^6D)6p$	$z\ ^7P^\circ$	4	*28331.77*	−39.91	1.59
		3	*28371.68*		1.74
		2			
		2	28411.95		
		2	*28609.97*		
$5d^6 6s(a\ ^6D)6p$	$z\ ^7F^\circ$	6	*29099.41*		1.48
		5			
		4			
		3			
		2			
		1			
		0			
		3	*29381.65*		1.49
		4	29394.30		
		2	30056.79		
		2	*30078.28*		1.48
		5	*30279.95*		1.47
		1	*30524.92*		1.55?
		4	*30591.45*		1.54
		2	*32457.44*		1.84
		4	*32684.61*		1.47
		3	*33124.48*		1.63
		3	*34125.40*		1.44
		5	*34365.35*		1.42
		4	*34803.82*		1.37
		2	*35090.50*		1.57
		3	*35615.92*		1.51
		1	*35919.55*		1.29
		2	*36345.81*		1.15
		2	*36634.54*		1.36
		3	*36806.27*		1.48

Os I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
		5	36817.94		1.28
		4	36826.39		1.41
		1	36979.51		1.31
		3	37808.58		1.26
		4	37908.77		1.45
		2	37981.71		1.45
		4	38130.09		1.24
		1	38244.90		1.55
		3	38264.16		1.23
		2	38330.75		1.41
		3	38486.01		1.61
		1	38618.44		0.29
		2	38741.19		1.60
		1	38875.97		1.90
		3	39332.95		1.18
		5	39406.98		1.18
		2	39493.80		0.93
		2	39674.89		1.91
		4	40087.01		1.36
		6	40290.44		1.30
		4	40361.92		1.32
		1	40497.48		2.18
		2	40888.05		0.82
		6	41023.22		1.23
		5	41225.02		1.27
		3	41231.98		1.08
		4	41725.58		1.04
		3	41875.93		1.30
		1	42299.83		1.00
		4	42310.25		1.22
		3	42316.68		1.03
		1	42422.36		1.86
		0	42582.75		
		2	42658.36		1.41

Os I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
		4	42746.57		1.32
		3	43011.56		1.05
		5	43401.82		1.22
		2	43437.13		1.00
		3	43515.75		1.21
		2	43610.81		1.05
		4	43754.64		1.05
		4	43863.69		1.20
		5	43876.12		1.13
		2	44075.34		1.16
		3	44144.14		1.13
		1	44474.88		1.01
		2	44662.97		1.31
		1	44729.93		1.01
		6	44839.09		1.19
		3	44869.71		1.35
		4	44892.67		1.22
		5	44921.12		1.27
		6	45315.88		1.30
		4	45388.69		1.07
		2	45503.45		1.32
		3	45561.99		1.00
		5	45758.63		1.23
		3	45774.55		1.12
		2	46169.54		1.19
		1	46202.36		0.62
		4	46263.46		1.12
		3	46327.99		1.11
		2	46406.90		1.15
		1	46515.45		1.19
		3	46776.29		1.25
		2	46812.87		1.15
		1 or 2	46947.12		

Os I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
		3	47057. 29		1. 21
		4	47158. 48		1. 12
5d^6 6s(a ^{6}D)7s	e ^{7}D	5 4 3 2 1	47196. 73 48737. 44 51138. 13	−1538. 71 −2400. 69	1. 57 1. 50 1. 71
		5	47200. 25		1. 31
		1	47477. 05		1. 14
		2	47539. 58		0. 99
		3	47614. 64		1. 12
		3	47827. 68		1. 11
		3	47845. 24		
		4	47853. 53		1. 17
		2	47934. 89		1. 21
		3	47957. 97		
		4	48131. 92		
		3	48302. 56		1. 14
		1	48338. 08		
		1	48409. 32		0. 98
		4	48525. 87		1. 07
		1	48546. 45		
		4	48756. 10		1. 16
		2	48773. 49		1. 15
		3	48874. 93		1. 28
		2	48999. 56		
		1	49053. 60		0. 89
		2	49112. 10		1. 10
		3	49138. 11		1. 23
		3	49202. 03		
		3	49461. 19		
		4	49481. 99		1. 20
		5	49534. 28		
		2	49614. 84		1. 10
		3	49680. 45		
		2	49872. 57		0. 93
		3	49903. 54		
		3	49947. 06		1. 19
		1	50007. 36		1. 42
		3	50153. 57		1. 16

Os I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
		4	50274. 91		1. 12
		4	50293. 56		1. 18
		2	50311. 71		1. 15
		3	50329. 97		1. 22
		5	50377. 19		1. 19
		3	50453. 80		
		4	50503. 53		1. 19
		3	50530. 59		
		1	50589. 89		1. 06
		6	50630. 26		1. 13
		1	50670. 83		1. 19
		5	50902. 87		1. 19
		4	50937. 24		1. 18
		2	50989. 77		1. 12
5d^6 6s(a ^{6}D)7s	e ^{5}D	4 3 2 1 0	51038. 49 52401. 81 52148. 69	−1363. 32 253. 12	1. 59 1. 80
		3	51042. 76		1. 25
		0	51166. 38		
		1	51217. 74		0. 66
		3	51228. 63		1. 27
		2	51311. 24		0. 90
		4	51329. 30		1. 07
		2	51545. 88		1. 50
		2	51655. 94		1. 09
		3	51758. 65		1. 13
		6	52042. 60		1. 17
		3	52138. 11		1. 08
		2	52162. 03		1. 21
		2	52337. 78		
		1	52374. 93		1. 14
		4	52490. 56		1. 11
		3	52563. 81		
		3	52604. 13		0. 99
		3	52677. 58		
		4	52715. 84		1. 13
		6	52801. 90		1. 13
		3	52937. 60		1. 24

Os I—Continued

Config.	Desig.	J	Level	Interval	Obs. g	Config.	Desig.	J	Level	Interval	Obs. g
		2	*53073.24*		1.20			2	56092.46		
		4	*53131.25*		1.19			5	56222.41		
		3	*53338.22*		1.39			4	56729.16		
		2	*53424.05*					1	*57198.30*		1.29
		4	*53447.29*		1.13			3	57334.23		
		1	*53454.11*					3	57826.90		
		6	*53572.09*		1.10			4	58098.19		
		2	53594.54					3	58688.20		
		2	*53647.07*					4	58768.76		
		3	53758.43					3	58905.20		
		3	*53886.85*					3	58957.24		
		2	*54049.89*		0.96			3	59074.97		
		2	*54064.40*					2	59105.95		
		1	*54302.45*		1.57			2	59142.16		
		6	*54328.11*		1.21			2	59170.43		
		1	*54484.27*		0.59			2	59229.84		
		3	54676.96		1.82			3	59282.85		
		2	*54753.20*					3	59556.04		
		1	*54800.46*		1.46			3	59582.97		
		1 or 2	54847.38					2	59602.19		
		2	*54867.69*					3	59750.04		
		3	55388.87		1.78			4	60649.49		
		5	55402.47		1.40	------	------	------	------		
		4	55419.00			Os II ($^6D_{4\frac{1}{2}}$)	*Limit*	------	70450		

October 1956.

Os I OBSERVED TERMS*

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}$ $4s^2\,4p^6\,4d^{10}\,4f^{14}\,5s^2\,5p^6+$	Observed Terms	
$5d^6\,6s^2$	{ $a\,^5D$ $a\,^3H$	
	ns ($n \geq 6$)	np ($n \geq 6$)
$5d^6\,6s(a\,^6D)nz$	{ $e\,^7D$ $e\,^5D$	$z\,^7P^{\circ}$ $z\,^7D^{\circ}$ $z\,^7F^{\circ}$
$5d^7(^4F)nz$	{ $a\,^5F$ $a\,^3F$	
$5d^7(^4P)nz$	{ $a\,^5P$ $a\,^3P$	

*For predicted terms in the spectra of the Os I isoelectronic sequence, see Vol. III, Introduction.

Os II

(Re I sequence; 75 electrons) $Z=76$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,4f^{14}\,5s^2\,5p^6\,5d^6\,6s\ {}^6D_{4\frac{1}{2}}$

$a\ {}^6D_{4\frac{1}{2}}$ K I. P. volts

The analysis is from van den Bosch who has furnished the tabular data in advance of publication, especially for inclusion here. His observations were made at the Massachusetts Institute of Technology, and include Zeeman spectrograms taken with the Bitter magnet. There are about 250 observed lines between 2280 A and 4550 A, of which 73 are classified.

No series are known. From a study of screening constants Finkelnburg and Humbach interpolate an ionization potential of 17 ± 1 volts.

Most of the levels have no *LS*-designations because of the departure from *LS*-coupling and the effect of configuration-interaction.

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J. C. van den Bosch, unpublished material (August 1956). (T) (C L) (Z E)

Os II

Config.	Desig.	J	Level	Interval	Obs. g
$5d^6(^5D)6s$	$a\ ^6D$	4½	0.00	−3593.15	1.52
		3½	3593.15	−335.79	1.57
		2½	3928.94	−1663.11	1.62
		1½	5592.05	−1044.52	1.79
		0½	6636.57		3.17
		2½	7891.93		1.70
		3½	11459.90		1.27
		2½	11654.08		1.55
		1½	13136.61		1.40
		3½	13203.88		1.25
		2½	13414.80		1.34
		4½	15605.58		1.14
		3½	17242.26		0.99
		1½	17424.39		0.97
		2½	17569.40		1.35
		5½	17688.64		1.20
		2½	19590.91		0.81
		3½	19985.93		1.10
		4½	21590.81		1.11
		2½	24465.66		1.27

Os II

Config.	Desig.	J	Level	Interval	Obs. g
		3½	24980.73		1.18
		2½	25452.13		1.09
		2½	*37321.53*		2.22
		3½	*39389.49*		1.85
$5d^6(^5D)6p$	$z\ ^6D°$	4½	*44315.40*	513.04	1.44
		3½	*43802.36*	−2571.15	1.56
		2½	*46373.51*	216.32	1.61
		1½	*46157.19*	−1970.89	1.74
		0½	*48128.08*		2.96
		2½	*48798.70*		1.39
		3½	*49149.39*		1.51
		4½	*51951.61*		1.40
		3½	*52206.48*		1.42
		3½	*54379.27*		1.34
		2½	*54445.19*		1.45
		2½	*55538.65*		1.09
		1½	*55635.92*		0.70
		3½	*56791.35*		1.28
		3½	*57402.59*		1.29

October 1956.

IRIDIUM

Ir I

77 electrons $Z=77$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^7\ 6s^2\ {}^4F_{4\frac{1}{2}}$

$a\ {}^4F_{4\frac{1}{2}}$ 75000 K I. P. 9 volts

The first regularities in Ir I were discovered by Snyder in 1900, who worked out an array for 240 lines, but never published it. Albertson extended this work in 1932, and again in 1938, when he reported that 1937 lines out of some 3100 were classified as combinations among 214 energy levels. He determined the approximate value of the limit by assuming "a simple series relationship" between $a\ {}^4F$ and $e\ {}^4F$.

A new description of the spectrum including Zeeman observations has been made recently by van Kleef, who has revised and extended the earlier work. He has also utilized Zeeman spectrograms taken by van den Bosch in 1949 at the Massachusetts Institute of Technology. His present line list extends from 2000.70 A to 8592.601 A. Out of a total of some 4000 lines he reports that approximately 2000 have been classified. He has furnished the present data in advance of publication, especially for inclusion here. There are 59 even and 163 odd levels known, but most of them have not been assigned *LS*-designations because of the departure from *LS*-coupling and the effect of configuration-interaction.

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Th. A. M. van Kleef, unpublished material (September 1956). (T) (C L) (Z E)

Ir I

Config.	Desig.	J	Level	Interval	Obs. g
$5d^7\,6s^2$	$a\ ^4F$	4½	0.00	−6323.91	1.30
		3½	6323.91	539.29	1.21
		2½	5784.62	1705.68	1.20
		1½	4078.94		1.12
$5d^8(^3F)6s$	$b\ ^4F$	4½	2834.98	−4271.63	1.33
		3½	7106.61	−2770.93	1.23
		2½	9877.54	−1953.55	1.17
		1½	11831.09		0.54
$5d^8(^3P)6s$	$a\ ^2P$	1½	10578.68	−1927.00	0.97
		0½	12505.68		1.22
$5d^8(^3F)6s$	$a\ ^2F$	2½	12218.47	869.43	1.13
		3½	13087.90		1.17
$5d^8(^3P)6s$	$a\ ^4P$	2½	12951.67	−3613.68	1.49
		1½	16565.35	−115.85	1.39
		0½	16681.20		2.61
$5d^7\,6s^2$	$a\ ^2G$	4½	13939.80	−3839.44	1.10
		3½	17779.24		0.92
$5d^7\,6s^2$	$b\ ^4P$	2½	16103.32	−2443.72	1.34
		1½	18547.04	−1689.66	1.39
		0½	20236.70		2.08
$5d^8(^1D)6s$	$a\ ^2D$	2½	19060.62	−3049.62	1.00
		1½	22110.24		1.00
$5d^7\,6s^2$	$a\ ^2H$	5½	19593.25	−3912.66	1.09
		4½	23505.91		1.04
$5d^7\,6s^2$	$b\ ^2D$	2½	23310.36	−2919.12	1.20
		1½	26229.48		0.94
$5d^7\,6s(^5F)6p$	$z\ ^6D^\circ$	4½	*26307.50*	−4222.16	1.48
		3½	*30529.66*	−2535.17	1.44
		2½	*33064.83*	601.25	1.50
		1½	*32463.58*	−3184.36	1.58
		0½	*35647.94*		1.30
$5d^8(^1G)6s$	$b\ ^2G$	3½	26365.16	1548.68	0.92
		4½	27913.84		1.03
$5d^9$	$c\ ^2D$	2½	26404.17	−1565.88	1.16
		1½	27970.05		0.85
$5d^7\,6s(^5F)6p$	$z\ ^6F^\circ$	5½	*28452.32*	−4061.11	1.40
		4½	*32513.43*	−1361.00	1.36
		3½	*33874.43*	−1045.40	1.38
		2½	*34919.83*	−1470.32	1.34
		1½	*36390.15*	−1730.79	1.14
		0½	*38120.94*		0.66
$5d^7\,6s(^5F)6p$	$z\ ^6G^\circ$	6½	*32830.78*	−1349.70	1.37
		5½	*34180.48*	−900.32	1.34
		4½	*35080.80*	−329.83	1.27
		3½	*35410.63*	−129.71	1.32
		2½	*35540.34*	−2152.41	1.59
		1½	*37692.75*		0.79
$5d^7\,6s(^5F)6p$	$z\ ^4D^\circ$	3½	*37515.31*	69.18	1.38
		2½	*37446.13*		1.33
		1½			
		0½			
$5d^7\,6s(^5F)6p$?	$z\ ^4F^\circ$	4½	*37871.69*	−286.55	1.25
		3½	*38158.24*		1.27
		2½			
		1½			
		4½	*38229.75*		1.22
		2½	*38358.13*		1.39
		1½	*38484.74*		1.44
		3½	*38568.06*		1.35
		0½	*39289.28*		1.58

Ir I

Config.	Desig.	J	Level	Interval	Obs. g
		2½	*39324.57*		1.22
		2½	*39805.97*		1.34
		5½	*39940.27*		1.32
		3½	*40291.19*		1.25
		4½	*40389.83*		1.23
		1½	*40524.73*		1.22
		3½	*40710.78*		1.33
		4½	*41118.71*		1.37
		0½	*41210.33*		2.39
		2½	*41522.22*		1.32
		0½	*42014.44*		0.76
		1½	*42029.14*		1.15
		5½	*42131.82*		1.29
		2½	*42267.86*		1.24
		4½	*42279.28*		1.38
		2½	*43071.78*		1.12
		3½	*43176.15*		1.12
		1½	*43200.89*		0.98
		3½	*43592.21*		1.45
		1½	*44569.85*		1.49
		2½	*44596.77*		1.26
		3½	*44642.67*		1.34
		4½	*44652.43*		1.25
		1½	*44785.44*		1.53
		3½	*45111.68*		1.08
		2½	*45185.95*		1.11
		1½	*45259.14*		1.27
		0½	*45415.26*		1.93
		0½	*45503.15*		0.32
		2½	*45570.89*		1.03
		3½	*45895.85*		1.16
		5½	*45957.33*		1.15
		2½	*46093.84*		1.21
		4½	*46220.32*		1.23
		4½	*46371.64*		1.36
		1½	*46471.84*		1.21
		1½	*46618.13*		1.05
		3½	*46979.02*		1.18
		2½	*47011.09*		1.13
		3½	*47165.12*		1.23
		0½	*47203.81*		2.31

Ir I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
		4½	*47205. 57*		1. 08
		2½	*47537. 29*		1. 21
		3½	*47548. 69*		1. 25
		1½	*47824. 93*		1. 46
		5½	*47858. 47*		1. 30
		2½	*48206. 57*		1. 27
		4½	*48299. 24*		1. 20
		1½	*48440. 83*		1. 24
		3½	*48448. 65*		1. 05
		3½	*48629. 22*		1. 19
		1½	*48801. 91*		1. 31
		2½	*49146. 44*		1. 22
		4½	*49158. 61*		1. 26
		1½	*49342. 51*		1. 22
		0½	*49446. 25*		0. 67
		2½	*49621. 32*		1. 36
		5½	*49719. 17*		1. 31
		2½	*49779. 37*		1. 35
		3½	*49823. 54*		1. 22
		4½	*50050. 69*		1. 15
		1½	*50100. 71*		1. 36
		2½	*50169. 88*		1. 00
		4½	*50434. 46*		1. 09
		0½	*50445. 02*		1. 16
		1½	*50564. 12*		1. 19
		3½	*50580. 39*		0. 95
		5½	*50606. 38*		1. 04
		3½	*51107. 94*		1. 15
		1½	*51166. 54*		1. 21
$5d^7 6s(^5F)7s$	$e\ ^6F$	5½	51175. 94	−1332. 95	1. 42
		4½	52508. 89		1. 38
		3½			
		2½			
		1½			
		0½			
		2½	*51427. 15*		1. 12
		4½	*51470. 74*		1. 22
		2½	*51814. 75*		1. 33
		3½	*51852. 38*		1. 24
		0½	*51983. 92*		1. 42
		2½	*52051. 75*		1. 25
		3½	*52134. 11*		1. 32
		3½	*52224. 37*		1. 30
		5½	*52266. 28*		0. 98
		1½	*52303. 65*		−0. 10

Ir I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
		2½	*52327. 33*		1. 17
		0½	*52388. 38*		1. 91
		2½	*52605. 16*		1. 16
		1½	*52806. 57*		1. 36
		2½	*53552. 93*		1. 20
		4½	*53642. 06*		1. 13
		3½	*53686. 99*		1. 12
		3½	*53771. 90*		1. 25
		5½	*54061. 29*		1. 14
		2½	*54119. 23*		0. 97
		3½	*54140. 83*		1. 10
		4½	*54263. 79*		1. 16
		1½	*54319. 92*		1. 23
		3½	*54566. 06*		0. 95
		2½	*54639. 31*		0. 98
		4½	*54667. 54*		1. 04
		3½	*54711. 10*		1. 05
		4½	54892. 63		1. 36
		3½	*54894. 82*		1. 06
		1½	*54985. 38*		1. 31
		4½	*55035. 94*		1. 10
		5½	*55114. 11*		1. 12
		1½	*55160. 88*		1. 17
		2½	55303. 80		1. 50
		3½	55382. 00		
		1½	*55497. 33*		1. 16
		3½	*55619. 39*		1. 16
		0½	*55635. 36*		1. 16
		1½	55885. 44		
		2½	*55913. 57*		1. 17
		4½	*55979. 05*		1. 16
		1½	*56016. 60*		1. 05
		0½	*56128. 84*		0. 65
		2½	*56264. 76*		1. 22
		3½	*56371. 08*		0. 96
		4½	56416. 08		1. 38
		1½	*56538. 45*		1. 23
		1½	*56788. 22*		1. 21
		3½	56792. 60		1. 27
		3½	*57042. 80*		1. 15
		3½	*57186. 64*		0. 99
		1½	*57247. 57*		1. 39

Config.	Desig.	*J*	Level	Interval	Obs. *g*	Config.	Desig.	*J*	Level	Interval	Obs. *g*
		3½	*57697.46*		0.98			1½	*60662.18*		0.94
		1½	*57737.04*		1.40			1½	60663.13		1.13
		4½	*57774.99*		1.14			2½	*60721.97*		1.00
		2½	*58042.02*		1.00			1½	*60794.40*		0.94
		2½	*58117.84*		1.36			3½	*61074.71*		1.13
		3½	*58470.79*					1½	61431.49		
		4½	*58570.57*		0.92			1½	61481.37		0.45
		3½	*58685.10*		1.03			3½	62018.84		1.35
		1½	*59155.42*		0.88			4½	*62079.82*		
		2½	*59354.02*		1.01			3½	62164.91		1.35
		5½	59525.87		1.28			5½	62208.67		1.20
		1½	*59564.11*		1.19			4½	62220.91		1.39
		0½	*59618.93*		2.01			3½	62377.72		1.23
		3½	59647.72		1.32			0½	62425.80		
		4½	*59725.87*					3½	62757.18		1.11
		2½	59824.53					4½	62835.40		1.28
		3½	59878.02		1.30			1½	63391.27		
		4½	60012.25		1.38			4½	63469.72		1.27
		2½	60062.45		1.35			3½	63976.18		1.41
		3½	*60263.04*					3½	64618.16		
		2½	*60411.48*								
		3½	*60643.36*			Ir II ($^5F_5$)	*Limit*	-----	75000		

October 1956.

Ir I Observed Terms*

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6+$	Observed Terms	
$5d^7\ 6s^2$	{ $b\ ^4P$, $a\ ^4F$, $b\ ^2D$, $a\ ^2G$, $a\ ^2H$	
$5d^9$	$c\ ^2D$	
	ns ($n \geq 6$)	*np* ($n \geq 6$)
$5d^8(^3F)ns$	{ $b\ ^4F$, $a\ ^2F$	
$5d^8(^3P)ns$	{ $a\ ^4P$, $a\ ^2P$	
$5d^8(^1D)ns$	$a\ ^2D$	
$5d^8(^1G)ns$	$b\ ^2G$	
$5d^7\ 6s(^5F)nx$	{ $e\ ^6F$	$z\ ^6D^\circ$, $z\ ^6F^\circ$, $z\ ^6G^\circ$; $z\ ^4D^\circ$, $z\ ^4F^\circ$

*For predicted terms in the spectra of the Ir I isoelectronic sequence, see Vol. III, Introduction.

PLATINUM

Pt I

78 electrons $Z=78$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,4f^{14}\,5s^2\,5p^6\,5d^9\,6s\;{}^3D_3$

$6s\;{}^3D_3$ 72300 K I. P. 9.0 volts

"A fairly complete wave-number system for Pt was sent to Rowland by Snyder in October, 1900", according to Meggers and Laporte, who interpreted the early regularities among the low levels when they observed Pt I in absorption in 1926. Haussmann studied the Zeeman effect of 173 lines and reported 72 levels in 1927. Livingood revised and extended Haussmann's work in 1929, and his paper is quoted for most of the level values in the table. Except for terms arising from the $5d^9\,ns$ and $5d^{10}$ configurations, the assignment of term designations on the basis of *LS*-coupling is extremely tentative, and the spectrum needs further study.

No homogeneous line list exists, although the observations extend from 1928.85 A to 10757.78 A. More than 440 lines have been classified. Kessler and Meggers have recently observed the Pt I spectrum from 6648.32 A to 10757.78 A. In an attempt to classify these lines in the long-wave region the writer prepared a complete line list and combination array; added 5 new "odd" levels; and rejected 2, namely, *46007.3* and *46793.9*. A number of strong lines in the newly observed region still remain unclassified, however. Further observations are needed to extend the analysis. Livingood's notation is in the first column of the table. The new levels can be detected from the absence of an entry in this column.

The observed *g*-values are from Livingood. These are also inadequate for further study of the spectrum.

Goble pointed out in 1935 that in the Pt I sequence *jj*-coupling applies more nearly than *LS*-coupling, to the levels having the configuration $5d^9(^2D)6p$. In *LS*-coupling this configuration gives rise to the terms $^{1,3}(P^\circ D^\circ F^\circ)$. In *jj*-coupling the same number of energy levels and the same resultant *J*-values occur, but each level is defined by two *j*-values, one for the *d*-electron (1½ or 2½), and one for the *p*-electron (0½ or 1½). By analogy with Au II and Hg III, Shenstone has suggested the *j*-values given in the table for 8 levels of this group. Of the remaining "odd" levels, three with $J=2$ and one with $J=1$ belong to the $5d^9\,6p$ configuration. The rest are doubtless from $5d^8\,6s\,6p$; but configuration-interaction and the lack of adequate observational material make it impossible to assign with assurance *LS*-designations with limit terms. Consequently, the levels are listed in numerical order in the table. A table giving the transformation from *jj*- to *LS*-coupling may be found in the book by Condon and Shortley, p. 294.

The limit is from the 6, $7s\;{}^3D_3$ series, which represents the removal of an *s*-electron from the $d^9\,s$ configuration. It has been derived by a Rydberg formula, but corrected to allow for the percentage error known to apply in the first long period, in cases where the more accurate Ritz formula could be compared with the Rydberg formula for series of three members.

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Pt I

L	Config.	Desig.	J	Level	Interval	Obs. g
$a\ {}^3D_3$	$5d^9(^2D_{2\frac{1}{2}})6s$	$6s\ \ {}^3D$	3	0.0	−775.9	
$a\ {}^3D_2$	''		2	775.9		1.01
$a\ {}^3F_4$	$5d^8\ 6s^2$		4	823.7		1.25
$a\ {}^1S_0$	$5d^{10}$	$5d^{10}\ {}^1S$	0	6140.0		
$a\ {}^3P_2$	$5d^8\ 6s^2$		2	6567.5		1.12
$a\ {}^3F_3$	$5d^8\ 6s^2$		3	10116.8		
$a\ {}^3D_1$	$5d^9(^2D_{1\frac{1}{2}})6s$	$6s\ \ {}^3D$	1	10132.0		
$a\ {}^1D_2$	$5d^9(^2D_{1\frac{1}{2}})6s$	$6s\ \ {}^1D$	2	13496.3		1.17
$a\ {}^3F_2$	$5d^8\ 6s^2$		2	15501.8		0.92
$a\ {}^3P_1$	$5d^8\ 6s^2$		1	18566.5		
$a\ {}^1G_4$	$5d^8\ 6s^2$		4	21967.1		1+?
$b\ {}^1D_2$	$5d^8\ 6s^2$		2	26638.6		0.97
$z\ {}^5D^\circ_4$	$5d^8\ 6s(^4F)6p$		4	*30157.0*		1.46
1°_2	$5d^9(^2D_{2\frac{1}{2}})6p_{\frac{1}{2}}$		2	*32620.0*		1.39
2°_5	$5d^8\ 6s\ 6p$		5	*33680.5*		1.32
3°_3	$5d^9(^2D_{2\frac{1}{2}})6p_{\frac{1}{2}}$		3	*34122.1*		1.21
4°_3	$5d^8\ 6s\ 6p$		3	*35321.7*		1.33
	$5d^8\ 6s\ 6p$		4	*36296.4*		
$z\ {}^5G^\circ_6$	$5d^8\ 6s(^4F)6p$		6	*36781.6*		1.33
5°_1	$5d^9(^2D_{1\frac{1}{2}})6p_{\frac{1}{2}}$		1	*36844.7*		1.09
6°_2			2	*37342.1*		1.15
7°_4	$5d^9(^2D_{2\frac{1}{2}})6p_{1\frac{1}{2}}$		4	*37590.7*		1.25
8°_3	$5d^9(^2D_{2\frac{1}{2}})6p_{1\frac{1}{2}}$		3	*37769.0*		1.17
$z\ {}^5F^\circ_5$	$5d^8\ 6s(^4F)6p$		5	*38536.2*		1.30
10°_2			2	*38815.9*		0.88
11°_4	$5d^8\ 6s\ 6p$		4	*40194.2*		1.21
12°_2			2	*40516.3*		1.38
13°_2			2	*40787.9*		1.20
14°_0	$5d^9(^2D_{1\frac{1}{2}})6p_{1\frac{1}{2}}$		0	*40878.5*		
15°_3	$5d^8\ 6s\ 6p$		3	*40970.1*		1.12
16°_1			1	*41802.7*		0.92
17°_3	$5d^8\ 6s\ 6p$		3	*42660.2*		1.19
18°_1			1	*43187.8*		1.39
19°_1			1	*43945.7*		1.21
20°_4	$5d^8\ 6s\ 6p$		4	*44432.7*		1.20
21°_2			2	*44444.4*		1.21
22°_3	$5d^8\ 6s\ 6p$		3	*44730.3*		1.19
23°_1			1	*45398.4*		1.52
24°_2			2	*46170.4*		1.01
25°_2			2	*46419.4*		0.87
26°_0	$5d^8\ 6s\ 6p$		0	*46433.9*		
27°_3	$5d^9(^2D_{1\frac{1}{2}})6p_{1\frac{1}{2}}$		3	*46622.5*		1.15

Pt I

L	Config.	Desig.	J	Level	Interval	Obs. g
28°_4	$5d^8\ 6s\ 6p$		4	*46965.1*		1.34
29°_1	$5d^9(^2D_{1\frac{1}{2}})6p_{1\frac{1}{2}}$		1	*47740.6*		1.43
30°_4	$5d^8\ 6s\ 6p$		4	*48351.9*		1.25
31°_2			2	*48535.6*		1.02
32°_3	$5d^8\ 6s\ 6p$		3	*48779.3*		1.22
33°_3	$5d^8\ 6s\ 6p$		3	*49286.1*		1.19
34°_1			1	*49544.5*		1.24
35°_2			2	*49880.8*		1.12
36°_1			1	*50055.3*		0.87
50°_3	$5d^8\ 6s\ 6p$		3	*51097.5*		1.21
37°_2			2	*51286.9*		1.13
38°_2			2	*51545.5*		1.25
39°_2			2	*51752.3*		1.34
40°_1			1	*52071.6*		1.22
$e\ {}^3D_3$	$5d^9(^2D_{2\frac{1}{2}})7s$	$7s\ \ {}^3D$	3	52379.3	−287.9	1.32
$e\ {}^3D_2$	''		2	52667.2		1.04
41°_2			2	*52708.3*		1.46
42°_1			1	*53019.2*		1.08
43°_2			2	*53953.3*		1.32
	$5d^8\ 6s\ 6p$		3	*54011.1*		
44°_3	$5d^8\ 6s\ 6p$		3	*54839.2*		1.21
$45^\circ_{1,2}$			2?	*55216.8*		0.96
	$5d^8\ 6s\ 6p$		3	*55536.0*		
$e\ {}^5F_5$	$5d^8\ 6s(^4F)7s$		5	55640.7		1.41
D_4			4	56784.4		1.27
			3	*57506.4?*		
			2	*57987.1*		
Q_3			3	59731.5		1.3
E_3			3	59751.2		
F_3			3	59764.3		1.27
G_1			1	59782.8		1.07
H_3			3	59872.1		1.23
I_4			4	59882.4		1.17
J_2			2	59908.1		1.02
$e\ {}^3D_1$	$5d^9(^2D_{1\frac{1}{2}})7s$	$7s\ \ {}^3D$	1	60357.8		0.52
$e\ {}^1D_2$	$5d^9(^2D_{1\frac{1}{2}})7s$	$7s\ \ {}^1D$	2	60640.6		1.08
M_3			3	60790.4		1.07
N_4			4	60884.0		1.29
$R_{4,5}$				64129.1		
T_6			6	64141.3		
O_4			4	64505.9		
	Pt II$(^2D_{2\frac{1}{2}})$	*Limit*	---	72300		

February 1955.

Pt II

(Ir I sequence; 77 electrons) $Z=78$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^9\ {}^2D_{2\frac{1}{2}}$

$5d^9\ {}^2D_{2\frac{1}{2}}$ 149723 I. P. 18.56 volts

The analysis is from Shenstone, who has observed the spectrum from 976.419 A to 4514.17 A and classified more than 550 lines. His spectrograms were made with three sources, namely, the arc and spark in air and the Schüler tube. He comments that "High even levels are calculated from arc or Schüler tube wave numbers which are approximately 2.5 greater than the spark wave numbers" given in his published table of classified lines.

Shenstone's notation is given in the left-hand column of the table, and his suggested term designations have been adopted. The limit terms in the "Config." column and the primes used in the "Desig." column to denote the different limits have been introduced by the writer. A single prime indicates that the Pt II term arises from the second highest limit term in Pt III; a double prime, the third limit term, etc. Since the Pt III spectrum has not yet been analyzed, the limit terms are assumed to lie in the same relative positions as indicated by the positions of the Pt II terms.

The doublet and quartet systems of terms are connected by observed intersystem combinations. Many levels have been assigned numbers only, "because the coupling is more nearly *jj* than *LS*."

The ionization limit has been derived from the $ns\ {}^4F_{4\frac{1}{2}}$ series ($n=6$ to 8) by means of a Ritz formula.

REFERENCE

A. G. Shenstone, Phil. Trans. Roy. Soc. (London) [A] **237**, No. 782, 453 (1938). (I P) (T) (C L)

Pt II

Shenstone	Config.	Desig.	J	Level	Interval
5d $^2D_{2\frac12}$	$5d^9$	$5d^9$ ^2D	2½	0.0	−8419.9
5d $^2D_{1\frac12}$			1½	8419.9	
6s $^4F_{4\frac12}$	$5d^8(^3F)6s$	6s ^4F	4½	4786.6	−4569.6
6s $^4F_{3\frac12}$			3½	9356.2	−3973.1
6s $^4F_{2\frac12}$			2½	13329.3	−2462.1
6s $^4F_{1\frac12}$			1½	15791.4	
$1_{2\frac12}$	$5d^8(^3P)6s$	6s′ ^4P	2½	16821.0	−4348.0
$2_{1\frac12}$			1½	21169.0	−548.5
$3_{\frac12}$			0½	21717.5	
6s $^2F_{3\frac12}$	$5d^8(^3F)6s$	6s ^2F	3½	18097.9	−5363.8
6s $^2F_{2\frac12}$			2½	23461.7	
$4_{1\frac12}$	$5d^8(^1D)6s$	6s″ ^2D	1½	23875.9	9043.3
$7_{2\frac12}$			2½	32919.2	
$6s^2$ $^4F_{4\frac12}$	$5d^7\,6s^2$	$6s^2$ ^4F	4½	24879.6	−9767.8
$6s^2$ $^4F_{3\frac12}$			3½	34647.4	−1836.8
$6s^2$ $^4F_{2\frac12}$			2½	36484.2	−1394.0
$6s^2$ $^4F_{1\frac12}$			1½	37878.2	
$5_{\frac12}$	$5d^8(^3P)6s$	6s′ ^2P	0½	27256.1	4981.5
$6_{1\frac12}$			1½	32237.6	
6s $^2G_{3\frac12}$	$5d^8(^1G)6s$	6s‴ ^2G	3½	29030.7	231.6
6s $^2G_{4\frac12}$			4½	29262.3	
6p $^4D^{\circ}_{3\frac12}$	$5d^8(^3F)6p$	6p $^4D^{\circ}$	3½	51408.3	−9782.0
$24^{\circ}_{2\frac12}$			2½	61190.3	4602.1
$21^{\circ}_{1\frac12}$			1½	56588.2	−6194.0
$26^{\circ}_{\frac12}$			0½	62782.2	
6p $^4G^{\circ}_{5\frac12}$	$5d^8(^3F)6p$	6p $^4G^{\circ}$	5½	61058.6	7183.1
$20^{\circ}_{4\frac12}$			4½	53875.5	
			3½		
$22^{\circ}_{2\frac12}$			2½	57018.3	
$23^{\circ}_{4\frac12}$	$5d^8(^3F)6p$	6p $^4F^{\circ}$	4½	60907.8	−757.8
$25^{\circ}_{3\frac12}$			3½	61665.6	
			2½		
			1½		
$27^{\circ}_{4\frac12}$			4½	62890.6	
$28^{\circ}_{3\frac12}$			3½	63739.2	
$29^{\circ}_{1\frac12}$			1½	64389.0	
$30^{\circ}_{2\frac12}$			2½	64757.6	
$31^{\circ}_{2\frac12}$			2½	65351.4	
$32^{\circ}_{\frac12}$			0½	65587.4	
$33^{\circ}_{1\frac12}$			1½	66028.3	
$34^{\circ}_{3\frac12}$			3½	66434.6	
$35^{\circ}_{2\frac12}$			2½	68658.4	
$36^{\circ}_{\frac12}$			0½	69236.1	
$37^{\circ}_{2\frac12}$			2½	69953.7	
$38^{\circ}_{4\frac12}$			4½	70181.3	
$39^{\circ}_{2\frac12}$			2½	70379.2	
$40^{\circ}_{2\frac12}$			2½	71315.0	
$41^{\circ}_{2\frac12}$			2½	71948.9	
$42^{\circ}_{2\frac12}$			2½	72991.5?	
$43^{\circ}_{1\frac12}$			1½	73086.7	

Pt II

Shenstone	Config.	Desig.	J	Level	Interval
$44^{\circ}_{4\frac12}$			4½	73431.3	
$45^{\circ}_{3\frac12}$			3½	73762.2	
$92^{\circ}_{1\frac12}$			1½	74000.1	
$46^{\circ}_{1\frac12}$			1½	74341.8	
$47^{\circ}_{2\frac12}$			2½	74619.6	
$48^{\circ}_{3\frac12}$			3½	74746.3	
$88^{\circ}_{\frac12}$			0½	74755.2	
$49^{\circ}_{3\frac12}$			3½	75185.3	
$50^{\circ}_{1\frac12}$			1½	75582.2	
$51^{\circ}_{2\frac12}$			2½	76462.1	
$93^{\circ}_{1\frac12}$			1½	76610.7	
$52^{\circ}_{4\frac12}$			4½	77519.9	
$53^{\circ}_{2\frac12}$			2½	78044.0	
$54^{\circ}_{4\frac12}$			4½	78906.8	
$55^{\circ}_{2\frac12}$			2½	79608.1	
$91^{\circ}_{2\frac12}$			2½	80858.7	
$56^{\circ}_{3\frac12}$			3½	81897.9	
$57^{\circ}_{\frac12}$			0½	82536.5	
$89^{\circ}_{1\frac12}$			1½	82824.5	
$58^{\circ}_{2\frac12}$			2½	82973.3	
$59^{\circ}_{3\frac12}$			3½	83352.7	
$60^{\circ}_{4\frac12}$			4½	84183.3	
$61^{\circ}_{3\frac12}$			3½	85701.1	
$62^{\circ}_{2\frac12}$			2½	89608.2	
$63^{\circ}_{4\frac12}$			4½	89863.9	
$90^{\circ}_{2\frac12}$			2½	92422.0	
$64^{\circ}_{3\frac12}$			3½	93336.1	
$65^{\circ}_{3\frac12}$			3½	93482.6	
$66^{\circ}_{4\frac12}$			4½	94022.9	
$67^{\circ}_{2\frac12}$			2½	95754.9	
7s $^4F_{4\frac12}$	$5d^8(^3F)7s$	7s ^4F	4½	95803.5	−811.1
7s $^4F_{3\frac12}$			3½	96614.6	
			2½		
			1½		
$68^{\circ}_{3\frac12}$			3½	97630.9	
$69^{\circ}_{2\frac12}$			2½	98187.5	
$70^{\circ}_{3\frac12}$			3½	98817.9	
$71^{\circ}_{2\frac12}$			2½	99209.6	
$72^{\circ}_{2\frac12}$			2½	99797.7	
$73^{\circ}_{2\frac12}$			2½	100239.7	
$74^{\circ}_{1\frac12}$			1½	100612.0	

Pt II—Continued

Shenstone	Config.	Desig.	J	Level	Interval
$75b_{46}$			1½	*100795.9*	
$76b_{46}$			3½	*100903.8*	
8_{u46}	$5d^8\ 7s$		2½	101199.3	
$77b_{46}$			3½	*101342.2*	
$78b_{46}$			2½	*101398.7*	
$79b_{46}$			3½	*101515.9?*	
$80b_{46}$			3½	*101549.4*	
$81b_{46}$			5½	*101618.8*	
$82b_{46}$			2½	*101867.7*	
$83b_{46}$			2½	*101917.3*	
$84b_{46}$			4½	*102086.6*	
$85b_{46}$			2½	*102415.2*	
$86b_{46}$			2½	*103463.9*	
$87b_{46}$			3½	*103517.4*	

August 1954.

Pt II—Continued

Shenstone	Config.	Desig.	J	Level	Interval
$6d\ ^4H_{u46}$	$5d^8(^3F)6d$	$6d\ \ ^4H$	6½	104762.9	125.8
9_{u46}			5½	104637.1	
			4½		
			3½		
11_{u46}	$5d^8(^3F)6d$	$6d\ \ ^4G$	5½	105066.4	
12_{u46}			4½	105387.5	
			3½		
			2½		
13_{u46}	$5d^8(^3F)6d$	$6d\ \ ^4F$	4½	106297.1	−136.3
14_{u46}			3½	106433.4	
			2½		
			1½		
$8s\ ^4F_{u46}$	$5d^8(^3F)8s$	$8s\ \ ^4F$	4½	120626.6?	
			3½		
			2½		
			1½		
15_{u46}	$5d^8\ 7d$		4½	124047.0	
16_{u46}	$5d^8\ 7d$		4½	124487.4	
	Pt III($^3F_4$)	*Limit*	----	149723	

Pt II Observed Terms*

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6$	Observed Terms		
$5d^9$	$5d^9\ ^2D$		
$5d^7\ 6s^2$	$6s^2\ ^4F$		
	$ns\ (n\geq 6)$	$np\ (n\geq 6)$	$nd\ (n\geq 6)$
$5d^8(^3F)ns$	6–8s ^4F 6s ^2F	$6p\ ^4D°$ $6p\ ^4F°$ $6p\ ^4G°$	$6d\ ^4F$ $6d\ ^4G$ $6d\ ^4H$
$5d^8(^3P)ns'$	$6s'\ ^4P$ $6s'\ ^2P$		
$5d^8(^1D)ns''$	$6s''\ ^2D$		
$5d^8(^1G)ns'''$	$6s'''\ ^2G$		

*For predicted terms in the spectra of the Ir I isoelectronic sequence, see Vol. III, Introduction.

GOLD

Au I

79 electrons $Z=79$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^{10}\ 6s\ ^2S_{0\frac{1}{2}}$

$6s\ ^2S_{0\frac{1}{2}}$ **74410.0 K** **I. P. 9.22 volts**

The analysis is from Platt and Sawyer, who have revised and extended the earlier work by Thorsen, McLennan and McLay, and others. They list 315 classified lines in the interval 1494.57 A and 10109.0 A. Their limit has been derived by fitting an extended Ritz formula to the $ns\ ^2S$ series ($n=7$ to 10; 9 to 12), and the $nd\ ^2D$ series ($n=10$ to 13), the average deviation being ± 3 K.

They have assigned arbitrary numbers to the miscellaneous levels; these numbers have been retained in the left column of the table.

The three-place observed g-values in the last column are from a manuscript by Green and Maxwell, furnished in advance of publication. The writer has determined the 5 two-place g-values: 4 from the observations of Symons and Daley, and 1 from data in the 1955 manuscript.

Platt and Sawyer state that the levels from the $5d^9\ 6s\ 6p$ configuration are divided into two widely separated groups "based, respectively, on $5d^9\ ^2D_{2\frac{1}{2}}$ and $5d^9\ ^2D_{1\frac{1}{2}}$ of Au III." This results from the fact that the Au I spectrum exhibits approximate jj-coupling, as is the case with Au II. The levels of Au II having as limits $^2D_{2\frac{1}{2}}$ and $^2D_{1\frac{1}{2}}$ in Au III are commonly designated $^3D_{3,2}$ and $^3D_1\ ^1D_2$ when the limit terms $^{1,3}D$ in LS-notation have their levels grouped in pairs. In jj-coupling the pairs are described by the notation $d^9_{2\frac{1}{2}}\ s_{0\frac{1}{2}}|_{32}$ and $d^9_{1\frac{1}{2}}\ s_{0\frac{1}{2}}|_{21}$, respectively. The complete configuration assignments have the form $d^9_{2\frac{1}{2}}$ and $d^9_{1\frac{1}{2}}$ combined with the j-values of the running p- and s-electrons, those for the running p-electron being $1\frac{1}{2}$ and $0\frac{1}{2}$, and for an s-electron $0\frac{1}{2}$. The order of coupling of the vectors is not yet known for Au I.

In the table the subscripts for the electrons have been introduced by Trees and the writer to describe more fully the configurations of the observed levels in jj-coupling. Although the criteria for these assignments are not definitive, yet a good guide is available in Au I from a study of the observed g-values. For this purpose, the theoretical g-values for jj-coupling have been calculated from the formula by Mack, on the assumption that the d- and s-electrons together are coupled with the p-electron. These are given in the following table, which is complete for the $5d^9\ 6s\ 6p$ array of levels. In the left column the jj-coupling notation is given for each of the four groups of levels. Beneath it is an arbitrary notation indicating the J-value of the limiting LS-level. This is included to facilitate comparison of the observed g-values with the theoretical Landé g-values in LS-coupling for the terms involved, which, in this case, are $^{2,4}P^\circ D^\circ F^\circ$ and $^2P^\circ D^\circ F^\circ$. Observed g-values are entered where known. Leaders indicates that the level is known but no observed g-value is available. Three levels marked "absent" have not yet been found.

Au I—Continued

g-values for *jj*-coupling						
Configuration	J	4½	3½	2½	1½	0½
$5d^9_{2½}\ 6s_{0½}\ 6p_{1½}$						
$5d^9\ 6s(^3D_3)6p_{1½}$	Theory	1.333	1.333	1.333	1.333	
	Observed	-------	1.372	-------	1.422	
$5d^9\ 6s(^3D_2)6p_{1½}$	Theory		1.181	1.166	1.120	0.800
	Observed		--------	1.222	-------	-------
$5d^9_{2½}\ 6s_{0½}\ 6p_{0½}$						
$5d^9\ 6s(^3D_3)6p_{0½}$	Theory		1.238	1.429		
	Observed		1.258	1.532		
$5d^9\ 6s(^3D_2)6p_{0½}$	Theory			0.987	1.147	
	Observed			1.011	1.064	
$5d^9_{1½}\ 6s_{0½}\ 6p_{1½}$						
$5d^9\ 6s(^3D_1)6p_{1½}$	Theory			1.000	1.111	1.889
	Observed			-------	-------	Absent
$5d^9\ 6s(^1D_2)6p_{1½}$	Theory		1.200	1.187	1.147	0.867
	Observed		Absent	1.30	-------	Absent
$5d^9_{1½}\ 6s_{0½}\ 6p_{0½}$						
$5d^9\ 6s(^3D_1)6p_{0½}$	Theory				0.556	0.444
	Observed				-------	-------
$5d^9\ 6s(^1D_2)6p_{0½}$	Theory			1.013	1.187	
	Observed			0.984	1.16	

For the running 6*d*-electron no attempt has been made to indicate the *j*-values, as the data are too incomplete. The limit term, together with a suggested *J*-value denoting the limiting level involved, is, however, tentatively assigned.

Some *LS*-designations for miscellaneous levels, given in the literature, are quoted here, and others have been added provisionally by Trees and the writer, but no attempt has been made to group the levels into terms because of the departure from *LS*-coupling. For $5d^9\ 6s\ 6p$ levels Racah has made a theoretical study of the arrangement of the terms in *LS*-coupling for Cu I, which, combined with the observed *g*-values has served as a general guide in making the present very tentative *LS*-term-assignments in Au I.

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Au I

PS	Config.	Desig.	J	Level	Interval	Obs. g
	$5d^{10}(^1S)6s$	$6s\ ^2S$	0½	0.0		1.997
	$5d^9\ 6s^2$	$6s^2\ ^2D$	2½ 1½	9161.3 21435.3	−12274.0	1.193 0.804
	$5d^{10}(^1S)6p$	$6p\ ^2P^\circ$	0½ 1½	*37358.9* *41174.3*	3815.4	0.661 1.334
1°	$5d^9_{2½}\ 6s_{0½}\ 6p_{0½}$	$^4P^\circ$	2½	*42163.5*		1.533
2°	″	$^4F^\circ$	3½	*45537.4*		1.258
3°	″	$^4F^\circ$	2½	*46174.5*		1.011
4°	$5d^9_{2½}\ 6s_{0½}\ 6p_{1½}$	$^4D^\circ$	2½	*46379.0*		
5°	″	$^4P^\circ$	1½	*47007.4*		1.422
6°	″	$^4F^\circ$	4½	*48697.4*		
7°	″	$^4D^\circ$	3½	*51089.1*		1.372
8°	$5d^9_{1½}\ 6s_{0½}\ 6p_{0½}$	$^2D^\circ$	1½	*51231.4*		1.064
9°	$5d^9_{2½}\ 6s_{0½}\ 6p_{1½}$	$^4F^\circ$	1½	*51485.0*		
10°	″	$^2D^\circ$	2½	*51653.9*		1.222
11°	″	$^2F^\circ$	3½	*52808.1*		
12°	″	$^4P^\circ$	0½	*53197.5*		
	$5d^{10}(^1S)7s$	$7s\ ^2S$	0½	54484.9		1.995
13°	$5d^9_{1½}\ 6s_{0½}\ 6p_{0½}$	$^4D^\circ$	0½	*55732.5*		
14°	″	$^4D^\circ$	1½	*56106.0*		1.16
15°	″	$^2F^\circ$	2½	*58616.5*		0.984
16°	″	$^2P^\circ$	1½	*58845.1*		
17°	$5d^9_{1½}\ 6s_{0½}\ 6p_{1½}$	$^2F^\circ$	2½	*59713.2*		
18°	″	$^2D^\circ$	2½	*61255.1*		1.30
19°	″	$^2D^\circ$	1½	*61563.3*		
20°	″	$^2P^\circ$	1½	*63005.1*		
	$5d^{10}(^1S)7p$	$7p\ ^2P^\circ$	0½ 1½	*60033.0* *60728.9*	695.9	1.33?
	$5d^{10}(^1S)6d$	$6d\ ^2D$	1½ 2½	61951.6 62033.7	82.1	0.787 1.193
	$5d^{10}(^1S)8s$	$8s\ ^2S$	0½	64742.4		2.01
	$5d^{10}(^1S)8p$	$8p\ ^2P^\circ$	0½ 1½	*66605.3* *66910.3*	305.0	
	$5d^{10}(^1S)7d$	$7d\ ^2D$	1½ 2½	67469.4 67510.7	41.3	
	$5d^{10}(^1S)5f$	$5f\ ^2F^\circ$	3½ 2½	*67485.3* *67490.0*	−4.7	
1	$5d^9\ 6s(^3D_3)7s$	^4D	3½	67811.5		1.423
	$5d^{10}(^1S)9s$	$9s\ ^2S$	0½	68680.5		
2	$5d^9\ 6s(^3D_3)7s$	^4D	2½	68705.1		1.270
	$5d^{10}(^1S)8d$	$8d\ ^2D$	1½ 2½	69971.3 70007.6	36.3	
	$5d^{10}(^1S)10s$	$10s\ ^2S$	0½	70617.3		
3	$5d^9\ 6s(^3D_2)7s$	^4D	1½	70653.3		0.905
4	$5d^9\ 6s(^3D_2)7s$	^2D	2½	71222.0		
	$5d^{10}(^1S)9d$	$9d\ ^2D$	1½ 2½	71354.4 71380.4	26.0	
	$5d^{10}(^1S)11s$	$11s\ ^2S$	0½	71713.8		
	$5d^{10}(^1S)10d$	$10d\ ^2D$	1½ 2½	72163.8 72170.8	7.0	
	$5d^{10}(^1S)12s$	$12s\ ^2S$	0½	72395.9		
	$5d^{10}(^1S)11d$	$11d\ ^2D$	1½ 2½	72690.1 72694.8	4.7	
	$5d^{10}(^1S)13s$	$13s\ ^2S$	0½	72847.5		
	$5d^{10}(^1S)12d$	$12d\ ^2D$	1½ 2½	73051.0 73054.8	3.8	
	$5d^{10}(^1S)14s$	$14s\ ^2S$	0½	73162.1		
	$5d^{10}(^1S)13d$	$13d\ ^2D$	1½ 2½	73308.1 73312.6	4.5	
	$5d^{10}(^1S)14d$	$14d\ ^2D$	1½ 2½	73500.4 73502.5	2.1	
	-----------	-------	----	--------		
	Au II ($^1S_0$)	*Limit*	....	74410.9		
5	$5d^9\ 6s(^3D_3)6d$		1½	76278.0		
6	″		2½	76566.7		
7	″		5½	76569.8		
8	″		3½	76731.9		
9	″		4½	76829.9		
10	″		1½	76906.4		
11	″		2½	76955.0		
12	$5d^9\ 6s(^3D_2)6d$		2½	78667.8		
13	″		1½	78819.9		
14	″		1½	79010.2		1.10
15	$5d^9\ 6s(^1D_2)6d$		2½	80772.7		
16	″		2½	81076.8		
17	″		1½	81683.7		

February 1955.

Au II

(Pt I sequence; 78 electrons) $Z=79$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^{10}\ {}^1S_0$

$5d^{10}\ {}^1S_0$ 165000 K I. P. 20.5 volts

The analysis is from Platt and Sawyer, who have revised and extended the earlier work by McLennan and McLay, Rao, Mack and Fromer, and others. There are approximately 200 classified lines in the interval 820.42 A to 8999.7 A, but the work is still far from complete.

The spectra of the Pt I isoelectronic sequence are of special theoretical interest because they approach *jj*-coupling rather than *LS*- or *Jl*-coupling. This appears more conspicuously in the spectra of higher ionization especially among the levels from the $5d^9(^2D)6p$ configuration. A detailed study of "The Four Vector Problem and Its Application to Energies and Intensities in Platinum-like Spectra" has been made by Goble. In *LS*-coupling this configuration gives rise to the terms $^{1,3}(P°D°F°)$. In *jj*-coupling the same number of energy levels and the same resultant *J*-values occur, but each level is defined by two *j*-values, one for the *d*-electron (1½ or 2½), and one for the *p*-electron (0½ or 1½).

In the table the writer has assigned *LS*-designations only for the terms from the $5d^9(^2D)ns$ configuration, although the *jj*-coupling applies here, also, as can be seen from the pairs of 6*s*- and 7*s*-levels. The levels from $5d^9(^2D)np$ have the *j*-values of the *d*- and *p*-electrons, as required for *jj*-coupling, indicated in the configuration column, the former being the same as the *J*-values of the limit term ^2D. Shenstone has suggested that by analogy with Hg III the configuration assignments by Platt and Sawyer be interchanged for the levels labeled 5° and 8°. This has been done in the table. A table giving the transformation from *jj*- to *LS*-coupling may be found in the book by Condon and Shortley, p. 294.

The observed *g*-values are from a manuscript on "The Zeeman Effect of Gold", furnished by Green and Maxwell in advance of publication. They supersede the early work by Symons and Daley.

Platt and Sawyer state that their limit is estimated, with the help of Rydberg term tables, from the known terms of the $5d^9\ ns$ and $5d^9\ np$ series.

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Au II

PS	Config.	Desig.	J	Level	Interval	Obs. g
1	$5d^{10}$	$5d^{10}\ ^1S$	0	0.0		
2	$5d^9(^2D_{2\frac{1}{2}})6s$	$6s\ ^3D$	3	15039.0	−2600.4	
3	"		2	17639.4	−10125.1	
4	$5d^9(^2D_{1\frac{1}{2}})6s$		1	27764.5		
5	$5d^9(^2D_{1\frac{1}{2}})6s$	$6s\ ^1D$	2	29620.8		1.04
6	$5d^8\ 6s^2$		4	40478.3		1.13
7	$5d^8\ 6s^2$		2	48510.4		1.02
8	$5d^8\ 6s^2$		3	52176.0		1.15
9	$5d^8\ 6s^2$		0	55436.6		
10	$5d^8\ 6s^2$		2	58191.2		1.08
11	$5d^8\ 6s^2$		1	59101.0		
12	$5d^8\ 6s^2$		4	61384.5		
1°	$5d^9(^2D_{2\frac{1}{2}})6p_{\frac{1}{2}}$		2	*63052.5*		1.45
2°	$5d^9(^2D_{2\frac{1}{2}})6p_{\frac{1}{2}}$		3	*65003.9*		1.04
13	$5d^8\ 6s^2$		2	68145.1		1.26
3°	$5d^9(^2D_{2\frac{1}{2}})6p_{1\frac{1}{2}}$		4	*72494.8*		1.15
4°	$5d^9(^2D_{2\frac{1}{2}})6p_{1\frac{1}{2}}$		2	*73177.8*		1.12
5°	$5d^9(^2D_{1\frac{1}{2}})6p_{\frac{1}{2}}$		1	*73403.1*		1.04
6°	$5d^9(^2D_{2\frac{1}{2}})6p_{1\frac{1}{2}}$		3	*74790.9*		1.30
7°	$5d^9(^2D_{1\frac{1}{2}})6p_{\frac{1}{2}}$		2	*76658.7*		1.38
8°	$5d^9(^2D_{2\frac{1}{2}})6p_{1\frac{1}{2}}$		1	*81659.1*		
9°	$5d^9(^2D_{1\frac{1}{2}})6p_{1\frac{1}{2}}$		0	*82613.0*		
10°	$5d^9(^2D_{1\frac{1}{2}})6p_{1\frac{1}{2}}$		3	*85699.2*		
11°	$5d^9(^2D_{1\frac{1}{2}})6p_{1\frac{1}{2}}$		1	*85707.0*		1.11

Au II

PS	Config.	Desig.	J	Level	Interval	Obs. g
12°	$5d^9(^2D_{1\frac{1}{2}})6p_{1\frac{1}{2}}$		2	*86565.1*		1.29
14	$5d^8\ 6s^2$		0	91114.4		
15	$5d^9(^2D_{2\frac{1}{2}})7s$	$7s\ ^3D$	3	108172.2	−458.6	1.20
16	"		2	108630.8		0.95
17	$5d^9(^2D_{2\frac{1}{2}})6d$		1	116049.8		
18	$5d^9(^2D_{2\frac{1}{2}})6d$		4	116945.8		
19	$5d^9(^2D_{2\frac{1}{2}})6d$		2	117065.2		
20	$5d^9(^2D_{2\frac{1}{2}})6d$		1	117296.9		
21	$5d^9(^2D_{2\frac{1}{2}})6d$		3	117511.4		
22	$5d^9(^2D_{2\frac{1}{2}})6d$		3	117982.8		
23	$5d^9(^2D_{2\frac{1}{2}})6d$		2	118028.9		
24	$5d^9(^2D_{2\frac{1}{2}})6d$		4	118167.6		
13°	$5d^9(^2D_{2\frac{1}{2}})7p_{\frac{1}{2}}$		2	*119446.1*		
14°	$5d^9(^2D_{2\frac{1}{2}})7p_{\frac{1}{2}}$		3	*120256.5*		
25	$5d^9(^2D_{1\frac{1}{2}})7s$	$7s\ ^3D$	1	120822.1		
15°	$5d^8\ 6s\ 6p$		2	*120952.0*		
26	$5d^9(^2D_{1\frac{1}{2}})7s$	$7s\ ^1D$	2	121117.8		
16°	$5d^9(^2D_{2\frac{1}{2}})7p_{1\frac{1}{2}}$		2	*121784.2*		
17°	$5d^9(^2D_{2\frac{1}{2}})7p_{1\frac{1}{2}}$		1	*121862.0*		
18°	$5d^9(^2D_{2\frac{1}{2}})7p_{1\frac{1}{2}}$		4	*123061.8*		
19°	$5d^9(^2D_{2\frac{1}{2}})7p_{1\frac{1}{2}}$		3	*123343.8*		1.03
	....	....	...	....		
	Au III$(^2D_{2\frac{1}{2}})$	*Limit*	...	165000		

February 1955.

MERCURY

Hg I

80 electrons $Z=80$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,4f^{14}\,5s^2\,5p^6\,5d^{10}\,6s^2\;{}^1S_0$

$6s^2\;{}^1S_0$ **84184.1 K** I. P. 10.43 volts

The first spectrum of mercury has attracted the attention of many investigators. Its lines exhibit isotope shifts, Paschen-Back Effect, hyperfine structure, Stark Effect, and other phenomena.

With the development of the electrodeless Hg^{198} lamp, the spectrum has come into special prominence. Meggers has pointed out that with this source the observed wavelengths provide ideal and reproducible standards. Barrell has shown that these standards can be reproduced with an accuracy of ± 1 part in 10^8. The line at 5460 A is being considered by the International Committee on Weights and Measures as the primary standard of length.

More than 600 lines have been classified in Hg I. The observations extend from 745.95 A to 39970 A. Observed intersystem combinations connect the terms of different multiplicities. A number of "forbidden" transitions have been observed. Mrozowski discusses the structure of two such lines, λ2967 and λ2269, as due to the "nuclear perturbational effect" in the odd isotopes. This has been discussed further by Kessler.

Shenstone and Russell comment that "The mercury spectrum contains long series but none of them is capable of giving an accurate limit" because of perturbations. The writer has obtained the value of the limit quoted in the table by adding the correction suggested by Walerstein, +2.8, to Paschen's value 84181.3. This limit gives fairly consistent values for converting the different lists of absolute term values later than Paschen's, into one complete array of terms starting from the ground state zero. The tabular values of the energy levels are not derived from a homogeneous line list, and the wavelengths are in general none too accurate, even though selected ones observed with the interferometer are measured with precision. Consequently, the narrow intervals given for some terms in the table are within the errors of observation and the terms may well be unresolved.

The three-place entries in the table are from Burns, Adams, and Longwell; and from Fowles, who has corrected the older values of $8p\;{}^1P^\circ_1$ and confirmed the suggestion by Shenstone and Russell regarding $6p'\;{}^1P^\circ$. The two-place entries are quoted from Humphreys, who has observed Hg I in the infrared, and also from Fowles. Walerstein has extended the series of "even" terms, and his values have been used for higher series members. For the "odd" series having the ${}^2S$ limit, most of the higher members are taken from Murakawa, but the terms $np\;{}^3P^\circ$ ($n=15$ to 26) and $np\;{}^1P^\circ$ ($n=17$ to 19) are from Kamiyama. Sawyer and Beese (1926) reported the $6p^2\;{}^3P_{1,0}$ levels. The level $6p^2\;{}^3P_0$ is from Garton and Rajaratnam, who designate the line reported by Selwyn at 1972.94 A as $6p\;{}^3P^\circ_1-6p^2\;{}^3P_0$, in place of Sawyer's line at 1900.1 A. The long series having as limit the ${}^2D$ term in Hg II are from the lines observed in absorption by Beutler, in the extreme ultraviolet. These lines represent transitions between the ground term $6s^2\;{}^1S_0$ and levels above the ionization limit. Only the transition $J=0$ to $J=1$ is to be expected, so the missing components of these high triplet terms have not been indicated in the table. There are also three components of triplet terms from this limit below the ionization limit, which are listed separately, namely, $6p'\;{}^3F^\circ_4$, $6p'\;{}^3D^\circ_3$, and $6p'\;{}^3P^\circ_2$. The J-values of the limit term and the values of the high ${}^2D$ limits are quoted from Beutler. Shenstone also discusses auto-ionization in his paper entitled "Ultra-Ionization Potentials in Mercury Vapor."

The observed g-values are from Green and Loring. Both Paschen-Back Effect and hyperfine structures have been extensively observed for selected lines, but few g-values are reported. Only a small selection of the many references to this type of work is given below.

Hg I—Continued

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Hg I

Config.	Desig.	J	Level	Interval	Obs. g
$5d^{10}\,6s^2$	$6s^2\ ^1S$	0	0.000		
$5d^{10}\,6s(^2S)6p$	$6p\ ^3P^{\circ}$	0	*37645.080*	1767.220	
		1	*39412.300*	4630.677	1.479
		2	*44042.977*		1.508
$5d^{10}\,6s(^2S)6p$	$6p\ ^1P^{\circ}$	1	*54068.781*		1.019
$5d^{10}\,6s(^2S)7s$	$7s\ ^3S$	1	62350.456		2.003
$5d^{10}\,6s(^2S)7s$	$7s\ ^1S$	0	63928.243		
$5d^9\,6s^2(^2D_{2\frac{1}{2}})6p$	$6p'\ ^3P^{\circ}$	2	*68886.60*		
$5d^{10}\,6s(^2S)7p$	$7p\ ^3P^{\circ}$	0	*69516.66*	145.23	
		1	*69661.89*	1545.62	
		2	*71207.51*		
$5d^{10}\,6s(^2S)7p$	$7p\ ^1P^{\circ}$	1	*71295.15*		
$5d^{10}\,6s(^2S)6d$	$6d\ ^1D$	2	71333.182		
$5d^{10}\,6s(^2S)6d$	$6d\ ^3D$	1	71336.164	60.056	
		2	71396.220	35.091	1.109
		3	71431.311		1.342
$5d^9\,6s^2(^2D_{2\frac{1}{2}})6p$	$6p'\ ^3D^{\circ}$	3	*73119.2*		
$5d^{10}\,6s(^2S)8s$	$8s\ ^3S$	1	73961.298		
$5d^{10}\,6s(^2S)8s$	$8s\ ^1S$	0	74404.590		

Hg I

Config.	Desig.	J	Level	Interval	Obs. g
$5d^{10}\,6s(^2S)8p$	$8p\ ^3P^{\circ}$	0	*76447.243*	19.824	
		1	*76467.067*	356.4	
		2	*76823.5*		
$5d^{10}\,6s(^2S)8p$	$8p\ ^1P^{\circ}$	1	*76863.964*		
$5d^9\,6s^2(^2D_{2\frac{1}{2}})6p$	$6p'\ ^3F^{\circ}$	4	*76945.41*		
$5d^{10}\,6s(^2S)7d$	$7d\ ^1D$	2	77064.097		
$5d^{10}\,6s(^2S)7d$	$7d\ ^3D$	1	77084.632	23.285	
		2	77107.917	21.618	
		3	77129.535		
$5d^{10}\,6s(^2S)5f$	$5f\ ^3F^{\circ}$	2	*77237.04*	2.16	
		3	*77239.20*	47.79	
		4	*77286.99*		
$5d^{10}\,6s(^2S)5f$	$5f\ ^1F^{\circ}$	3	*77241.68*		
$5d^{10}\,6s(^2S)9s$	$9s\ ^3S$	1	78216.261		
$5d^{10}\,6s(^2S)9s$	$9s\ ^1S$	0	78404.387		
$5d^9\,6s^2(^2D_{2\frac{1}{2}})6p$	$6p'\ ^1D^{\circ}$	2	*78676.7*		
$5d^9\,6s^2(^2D_{2\frac{1}{2}})6p$	$6p'\ ^1P^{\circ}$	1	*78813*		
$5d^{10}\,6s(^2S)9p$	$9p\ ^3P^{\circ}$	0	*79375.783*	36.962	
		1	*79412.745*	200.6	
		2	*79613.3*		

Hg I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
5d^{10} 6s(^{2}S)8d	8d ^{1}D	2	79660.785		
5d^{10} 6s(^{2}S)8d	8d ^{3}D	1	79678.706	11.592	
		2	79690.300	12.334	
		3	79702.634		
5d^{10} 6s(^{2}S)6f	6f ^{3}F°	2	79743.7	1.3	
		3	79745.0	3.3	
		4	79748.3		
5d^{10} 6s(^{2}S)6f	6f ^{1}F°	3	79745.3		
5d^{10} 6s(^{2}S)9p	9p ^{1}P°	1	79964.1		
5d^{10} 6s(^{2}S)10s	10s ^{3}S	1	80268.056		
5d^{10} 6s(^{2}S)10s	10s ^{1}S	0	80365.653		
5d^{10} 6s(^{2}S)10p	10p ^{3}P°	0	80902.27	14.42	
		1	80916.686	106.2	
		2	81022.9		
5d^{10} 6s(^{2}S)9d	9d ^{1}D	2	81057.749		
5d^{10} 6s(^{2}S)9d	9d ^{3}D	1	81071.027	6.8	
		2	81077.8	7.3	
		3	81085.126		
5d^{10} 6s(^{2}S)7f	7f ^{3}F°	2	81103.9	0.7	
		3	81104.6	2.5	
		4	81107.1		
5d^{10} 6s(^{2}S)7f	7f ^{1}F°	3	81106.5		
5d^{10} 6s(^{2}S)10p	10p ^{1}P°	1	81153.614		
5d^{10} 6s(^{2}S)11s	11s ^{3}S	1	81416.352		
5d^{10} 6s(^{2}S)11s	11s ^{1}S	0	81473.4		
5d^{10} 6s(^{2}S)11p	11p ^{3}P°	0	81800.0	11.9	
		1	81811.876	61.959	
		2	81873.835		
5d^{10} 6s(^{2}S)10d	10d ^{1}D	2	81895.0		
5d^{10} 6s(^{2}S)10d	10d ^{3}D	1	81904.5	4.2	
		2	81908.7	4.9	
		3	81913.632		
5d^{10} 6s(^{2}S)8f	8f ^{3}F°	2	81923.5	0.8	
		3	81924.3	3.5	
		4	81927.8		
5d^{10} 6s(^{2}S)8f	8f ^{1}F°	3	81925.3		
5d^{10} 6s(^{2}S)11p	11p ^{1}P°	1	81942.444		
5d^{10} 6s(^{2}S)12s	12s ^{3}S	1	82124.081		
5d^{10} 6s(^{2}S)12s	12s ^{1}S	0	82160.8		
5d^{10} 6s(^{2}S)12p	12p ^{3}P°	0			
		1	82379.0	43.6	
		2	82422.60		
5d^{10} 6s(^{2}S)11d	11d ^{1}D	2	82436.2		
5d^{10} 6s(^{2}S)11d	11d ^{3}D	1	82443.0	2.9	
		2	82445.9	3.3	
		3	82449.2		
5d^{10} 6s(^{2}S)9f	9f ^{3}F°	2	82454.9	0.3	
		3	82455.2	1.5	
		4	82456.7		
5d^{10} 6s(^{2}S)9f	9f ^{1}F°	3	8[illegible]455.3		
5d^{10} 6s(^{2}S)12p	12p ^{1}P°	1	82464.05		

Hg I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
5d^{10} 6s(^{2}S)13s	13s ^{3}S	1	82591.3		
5d^{10} 6s(^{2}S)13s	13s ^{1}S	0	82616.2		
5d^{10} 6s(^{2}S)13p	13p ^{3}P°	0			
		1	82765.9	29.1	
		2	82795.03		
5d^{10} 6s(^{2}S)12d	12d ^{1}D	2	82807.421		
5d^{10} 6s(^{2}S)12d	12d ^{3}D	1	82811.2	1.3	
		2	82812.5	2.8	
		3	82815.3		
5d^{10} 6s(^{2}S)10f	10f ^{3}F°	2	82818.7	1.1	
		3	82819.8	0.3	
		4	82820.1		
5d^{10} 6s(^{2}S)10f	10f ^{1}F°	3	82820.4		
5d^{10} 6s(^{2}S)13p	13p ^{1}P°	1	82823.94		
5d^{10} 6s(^{2}S)14s	14s ^{3}S	1	82915.6		
5d^{10} 6s(^{2}S)14s	14s ^{1}S	0	82933.2		
5d^{10} 6s(^{2}S)14p	14p ^{3}P°	0			
		1	83039.3	21.9	
		2	83061.2		
5d^{10} 6s(^{2}S)13d	13d ^{1}D	2	83069.2		
5d^{10} 6s(^{2}S)13d	13d ^{3}D	1	83073.4	0.8	
		2	83074.2	2.1	
		3	83076.3		
5d^{10} 6s(^{2}S)11f	11f ^{3}F°	2	83079.0	1.1	
		3	83080.1	−0.1	
		4	83080.0		
5d^{10} 6s(^{2}S)11f	11f ^{1}F°	3	83080.4		
5d^{10} 6s(^{2}S)14p	14p ^{1}P°	1	83084.0		
5d^{10} 6s(^{2}S)15s	15s ^{3}S	1	83149.9		
5d^{10} 6s(^{2}S)15s	15s ^{1}S	0	83162.9		
5d^{10} 6s(^{2}S)15p	15p ^{3}P°	0			
		1	83240.1	18.6	
		2	83258.7		
5d^{10} 6s(^{2}S)14d	14d ^{1}D	2	83263.9		
5d^{10} 6s(^{2}S)14d	14d ^{3}D	1	83266.9	1.0	
		2	83267.9	1.7	
		3	83269.6		
5d^{10} 6s(^{2}S)12f	12f ^{3}F°	2	83271.0	0.9	
		3	83271.9	0.6	
		4	83272.5		
5d^{10} 6s(^{2}S)12f	12f ^{1}F°	3	83273.4		
5d^{10} 6s(^{2}S)15p	15p ^{1}P°	1	83280.5		
5d^{10} 6s(^{2}S)16s	16s ^{3}S	1	83325.0		
5d^{10} 6s(^{2}S)16s	16s ^{1}S	0	83334.8		
5d^{10} 6s(^{2}S)16p	16p ^{3}P°	0			
		1	83396.7	10.5	
		2	83407.2		
5d^{10} 6s(^{2}S)15d	15d ^{1}D	2	83411.9		
5d^{10} 6s(^{2}S)15d	15d ^{3}D	1	83413.9	0.9	
		2	83414.8	0.9	
		3	83415.7		

Hg I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$5d^{10}\,6s(^2S)13f$	$13f\ ^3F^{\circ}$	2	*83416.1*	1.9	
		3	*83418.0*	2.9	
		4	*83420.9*		
$5d^{10}\,6s(^2S)13f$	$13f\ ^1F^{\circ}$	3	*83418.7*		
$5d^{10}\,6s(^2S)16p$	$16p\ ^1P^{\circ}$	1	*83420.3*		
$5d^{10}\,6s(^2S)17s$	$17s\ ^3S$	1	83459.0		
$5d^{10}\,6s(^2S)17s$	$17s\ ^1S$	0	83466.4		
$5d^{10}\,6s(^2S)17p$	$17p\ ^3P^{\circ}$	0			
		1	*83512.7*	8.9	
		2	*83521.6*		
$5d^{10}\,6s(^2S)16d$	$16d\ ^1D$	2	83526.7		
$5d^{10}\,6s(^2S)16d$	$16d\ ^3D$	1	83528.5	0.4	
		2	83528.9	1.0	
		3	83529.9		
$5d^{10}\,6s(^2S)17p$	$17p\ ^1P^{\circ}$	1	*83530.7*		
$5d^{10}\,6s(^2S)14f$	$14f\ ^3F^{\circ}$	2			
		3	*83530.9*	7.7	
		4	*83538.6*		
$5d^{10}\,6s(^2S)18s$	$18s\ ^3S$	1	83564.0		
$5d^{10}\,6s(^2S)18s$	$18s\ ^1S$	0	83569.6		
$5d^{10}\,6s(^2S)18p$	$18p\ ^3P^{\circ}$	0			
		1	*83601.9*	12.0	
		2	*83613.9*		
$5d^{10}\,6s(^2S)15f$	$15f\ ^3F^{\circ}$	2			
		3	*83603.2*	6.1	
		4	*83609.3*		
$5d^{10}\,6s(^2S)17d$	$17d\ ^1D$	2	83617.4		
$5d^{10}\,6s(^2S)17d$	$17d\ ^3D$	1	83618.5	1.4	
		2	83619.9	0.4	
		3	83620.3		
$5d^{10}\,6s(^2S)18p$	$18p\ ^1P^{\circ}$	1	*83619.9*		
$5d^{10}\,6s(^2S)19s$	$19s\ ^3S$	1	83647.9		
$5d^{10}\,6s(^2S)19s$	$19s\ ^1S$	0	83651.2		
$5d^{10}\,6s(^2S)19p$	$19p\ ^3P^{\circ}$	0			
		1	*83677.9*	8.1	
		2	*83686.0*		
$5d^{10}\,6s(^2S)18d$	$18d\ ^1D$	2	83690.7		
$5d^{10}\,6s(^2S)19p$	$19p\ ^1P^{\circ}$	1	*83691.3*		
$5d^{10}\,6s(^2S)18d$	$18d\ ^3D$	1	83692.7	0.1	
		2	83692.8	0.8	
		3	83693.6		
$5d^{10}\,6s(^2S)20s$	$20s\ ^3S$	1	83715.4		
$5d^{10}\,6s(^2S)20s$	$20s\ ^1S$	0	83718.8		
$5d^{10}\,6s(^2S)20p$	$20p\ ^3P^{\circ}$	0			
		1			
		2	*83745.7*		
$5d^{10}\,6s(^2S)19d$	$19d\ ^1D$	2	83750.3		
$5d^{10}\,6s(^2S)19d$	$19d\ ^3D$	3	83753.1	0.5	
		2	83752.6	−0.9	
		1	83753.5		
$5d^{10}\,6s(^2S)21s$	$21s\ ^3S$	1	83771.3		

Hg I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$5d^{10}\,6s(^2S)21s$	$21s\ ^1S$	0	83772.7		
$5d^{10}\,6s(^2S)21p$	$21p\ ^3P^{\circ}$	0			
		1			
		2	*83792.8*		
$5d^{10}\,6s(^2S)20d$	$20d\ ^1D$	2	83798.3		
$5d^{10}\,6s(^2S)20d$	$20d\ ^3D$	3	83802.4	−0.2	
		2	83802.6	−0.3	
		1	83802.9		
$5d^{10}\,6s(^2S)22s$	$22s\ ^3S$	1	83817.6		
$5d^{10}\,6s(^2S)22p$	$22p\ ^3P^{\circ}$	0			
		1			
		2	*83834.5*		
$5d^{10}\,6s(^2S)21d$	$21d\ ^1D$	2	83842.7		
$5d^{10}\,6s(^2S)21d$	$21d\ ^3D$	3	83843.6	−0.7	
		2	83844.3	0.3	
		1	83844.0		
$5d^{10}\,6s(^2S)23s$	$23s\ ^3S$	1	83856.6		
$5d^{10}\,6s(^2S)23p$	$23p\ ^3P^{\circ}$	0			
		1			
		2	*83868.0*		
$5d^{10}\,6s(^2S)22d$	$22d\ ^3D$	3	83879.0	−0.3	
		2	83879.3	0.2	
		1	83879.1		
$5d^{10}\,6s(^2S)24s$	$24s\ ^3S$	1	83889.7		
$5d^{10}\,6s(^2S)24p$	$24p\ ^3P^{\circ}$	0			
		1			
		2	*83892.6*		
$5d^{10}\,6s(^2S)23d$	$23d\ ^3D$	3	83909.2	−0.6	
		2	83909.8		
		1			
$5d^{10}\,6s(^2S)25s$	$25s\ ^3S$	1	83918.0		
$5d^{10}\,6s(^2S)25p$	$25p\ ^3P^{\circ}$	0			
		1			
		2	*83920.8*		
$5d^{10}\,6s(^2S)24d$	$24d\ ^3D$	3	83933.9	−1.1	
		2	83935.0		
		1			
$5d^{10}\,6s(^2S)26p$	$26p\ ^3P^{\circ}$	0			
		1			
		2	*83942.0*		
$5d^{10}\,6s(^2S)25d$	$25d\ ^3D$	3	83955.7	−0.5	
		2	83956.2		
		1			
$5d^{10}\,6s(^2S)26d$	$26d\ ^3D$	3	83975.6	−0.4	
		2	83976.0		
		1			
$5d^{10}\,6s(^2S)27d$	$27d\ ^3D$	3	83993.4		
		2			
		1			
$5d^{10}\,6s(^2S)28d$	$28d\ ^3D$	3	84007.4		
		2			
		1			
$5d^{10}\,6s(^2S)29d$	$29d\ ^3D$	3	84021.8		
		2			
		1			

Hg I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
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Hg II($^2S_{1/2}$)	*Limit*	---	84184.1		
$5d^9\ 6s^2(^2D_{2\frac{1}{2}})6p$	$6p'\ ^3P^\circ$	1	*88760*		
$5d^{10}\ 6p^2$	$6p^2\ ^3P$	0	90096		
		1	93980	3884	
		2			
$5d^9\ 6s^2(^2D_{1\frac{1}{2}})6p$	$6p'\ ^3D^\circ$	1	*93737*		
$5d^9\ 6s^2(^2D_{2\frac{1}{2}})7p$	$7p'\ ^1P^\circ$	1	*105881*		
$5d^9\ 6s^2(^2D_{2\frac{1}{2}})8p$	$8p'\ ^1P^\circ$	1	*112272*		
$5d^9\ 6s^2(^2D_{2\frac{1}{2}})5f?$	$5f'\ ^3P^\circ?$	1	*112726*		
$5d^9\ 6s^2(^2D_{2\frac{1}{2}})9p$	$9p'\ ^1P^\circ$	1	*115035*		
$5d^9\ 6s^2(^2D_{2\frac{1}{2}})6f$	$6f'\ ^3P^\circ?$	1	*115242*		
$5d^9\ 6s^2(^2D_{2\frac{1}{2}})10p$	$10p'\ ^1P^\circ$	1	*116498*		
$5d^9\ 6s^2(^2D_{2\frac{1}{2}})7f$	$7f'\ ^3P^\circ?$	1	*116616*		
$5d^9\ 6s^2(^2D_{2\frac{1}{2}})11p$	$11p'\ ^1P^\circ$	1	*117355*		
$5d^9\ 6s^2(^2D_{2\frac{1}{2}})8f$	$8f'\ ^3P^\circ?$	1	*117422*		
$5d^9\ 6s^2(^2D_{2\frac{1}{2}})12p$	$12p'\ ^1P^\circ$	1	*117915*		
$5d^9\ 6s^2(^2D_{2\frac{1}{2}})9f$	$9f'\ ^3P^\circ?$	1	*117964*		
$5d^9\ 6s^2(^2D_{2\frac{1}{2}})13p$	$13p'\ ^1P^\circ$	1	*118307*		
$5d^9\ 6s^2(^2D_{2\frac{1}{2}})14p$	$14p'\ ^1P^\circ$	1	*118565*		
$5d^9\ 6s^2(^2D_{2\frac{1}{2}})15p$	$15p'\ ^1P^\circ$	1	*118762*		
$5d^9\ 6s^2(^2D_{2\frac{1}{2}})16p$	$16p'\ ^1P^\circ$	1	*118912*		
$5d^9\ 6s^2(^2D_{2\frac{1}{2}})17p$	$17p'\ ^1P^\circ$	1	*119029*		
$5d^9\ 6s^2(^2D_{2\frac{1}{2}})18p$	$18p'\ ^1P^\circ$	1	*119119*		
Hg II($^2D_{2\frac{1}{2}}$)	*Limit*	---	119692		
$5d^9\ 6s^2(^2D_{1\frac{1}{2}})7p$	$7p'\ ^3P^\circ$	1	*119953*		
$5d^9\ 6s^2(^2D_{1\frac{1}{2}})7p$	$7p'\ ^3D^\circ$	1	*120715*		
$5d^9\ 6s^2(^2D_{1\frac{1}{2}})8p$	$8p'\ ^3P^\circ$	1	*126973*		
$5d^9\ 6s^2(^2D_{1\frac{1}{2}})8p$	$8p'\ ^3D^\circ$	1	*127254*		
$5d^9\ 6s^2(^2D_{1\frac{1}{2}})5f$	$5f'\ ^1P^\circ?$	1	*127770*		
$5d^9\ 6s^2(^2D_{1\frac{1}{2}})9p$	$9p'\ ^3P^\circ$	1	*129921*		
$5d^9\ 6s^2(^2D_{1\frac{1}{2}})9p$	$9p'\ ^3D^\circ$	1	*130053*		
$5d^9\ 6s^2(^2D_{1\frac{1}{2}})6f$	$6f'\ ^1P^\circ?$	1	*130221*		
$5d^9\ 6s^2(^2D_{1\frac{1}{2}})10p$	$10p'\ ^3P^\circ$	1	*131444*		
$5d^9\ 6s^2(^2D_{1\frac{1}{2}})10p$	$10p'\ ^3D^\circ$	1	*131535*		
$5d^9\ 6s^2(^2D_{1\frac{1}{2}})7f$	$7f'\ ^1P^\circ?$	1	*131644*		
$5d^9\ 6s^2(^2D_{1\frac{1}{2}})11p$	$11p'\ ^3P^\circ$	1	*132345*		
$5d^9\ 6s^2(^2D_{1\frac{1}{2}})8f$	$8f'\ ^1P^\circ?$	1	*132602*		
$5d^9\ 6s^2(^2D_{1\frac{1}{2}})12p$	$12p'\ ^3P^\circ$	1	*132921*		
$5d^9\ 6s^2(^2D_{1\frac{1}{2}})13p$	$13p'\ ^3P^\circ$	1	*133312*		
$5d^9\ 6s^2(^2D_{1\frac{1}{2}})14p$	$14p'\ ^3P^\circ$	1	*133588*		
$5d^9\ 6s^2(^2D_{1\frac{1}{2}})15p$	$15p'\ ^3P^\circ$	1	*133792*		
$5d^9\ 6s^2(^2D_{1\frac{1}{2}})16p$	$16p'\ ^3P^\circ$	1	*133940*		
$5d^9\ 6s^2(^2D_{1\frac{1}{2}})17p$	$17p'\ ^3P^\circ$	1	*134057*		
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Hg II($^2D_{1\frac{1}{2}}$)	*Limit*	---	134732		

February 1955.

Hg I Observed Terms*

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}$ $4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6+$	Observed Terms	
$5d^{10}\ 6s^2$	$6s^2\ ^1S$	
$5d^{10}\ 6p^2$	$6p^2\ ^3P$	
	$ns\ (n \geq 7)$	$np\ (n \geq 6)$
$5d^{10}\ 6s(^2S)nx$	{ 7 to 25s ^3S 7 to 21s ^1S	6 to 26p $^3P^\circ$ 6 to 19p $^1P^\circ$
$5d^9\ 6s^2(^2D)nx'$	{	6 to 17p' $^3P^\circ$ 6 to 10p' $^3D^\circ$ 6p' $^3F^\circ$ 6 to 18p' $^1P^\circ$ 6p' $^1D^\circ$
	$nd\ (n \geq 6)$	$nf\ (n \geq 5)$
$5d^{10}\ 6s(^2S)nx$	{ 6 to 29d ^3D 6 to 21d ^1D	5 to 15f $^3F^\circ$ 5 to 13f $^1F^\circ$
$5d^9\ 6s^2(^2D)nx'$	{	5 to 9f' $^3P^\circ$ 5 to 8f' $^1P^\circ$

*For predicted terms in the spectra of the Hg I isoelectronic sequence, see Vol. III, Introduction.

Hg II

(Au I sequence; 79 electrons) $Z=80$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^{10}\ 6s\ {}^2S_{0½}$

$6s\ {}^2S_{0½}$ 151280 K I. P. 18.751 volts

Although the doublet series having as a limit the term $^1S_0$ in Hg III are well established in Hg II, the analysis needs to be revised and extended for terms from higher limits. In the table, nearly all the series terms are from Paschen, who revised and extended the earlier work by Carroll and others. In addition, he found the $6s^2\ {}^2D$ term and the levels labeled Z, Y, U, X, C, B, and A in the left column of the table, headed "Author". McLennan, McLay, and Crawford extended the analysis in 1931 and added the levels that are designated by numerals in this column. Naudé (1929) suggested a slight improvement in Paschen's 9 ^2D term value, and added the series terms labeled 10 $^2D_{3,2}$, 12 $^2D_2$, 13 $^2D_2$, and 9 $^2F_3$ in Paschen's notation. He also published a number of quartet terms, most of which are included among the miscellaneous numbered levels. Three levels 76924, 77041, 91064, and one above the ionization limit have been omitted here.

As suggested by Edlén (letter, 1958), it has been assumed that the g- and h-orbits do not penetrate, and that the lowest ^2G term is $5g\ {}^2G$.

There are approximately 300 classified lines in the interval 893.10 A to 10590 A, including the infrared extension by Rasmussen, who added the $5g\ {}^2G$ term.

Paschen calls attention to the strong line observed in emission at 2814.93 A, whose designation is $6s\ {}^2S_{0½}-6s^2\ {}^2D_{2½}$. This line is "forbidden" in two senses, in that it is produced by the transition between two "even" terms and also violates the J-rule.

As in Au I, the levels from the $5d^9\ 6s\ 6p$ configuration in Hg II exhibit characteristics of jj-coupling. They have as limits the pairs $^3D_{3,2}$ and $^3D_1\ {}^1D_2$ in Hg III, which, in jj-coupling would be designated as $d^9_{2½}\ s_{½}|_{32}$ and $d^9_{1½}\ s_{½}|_{21}$, respectively. The complete jj-coupling notation for the 23 levels to be expected from this configuration should indicate, also, the j-values of the running p-electron (0½ or 1½). Further details regarding this notation may be found in the text for Au I. By comparison with isoelectronic spectra, Trees and the writer have extended the published configuration assignments in jj-coupling, very tentatively, to include 19 levels in this group. A number of "odd" levels still remain unassigned pending further study of the spectrum.

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Hg II

Author	Config.	Desig.	J	Level	Interval
1S	$5d^{10}(^1S)6s$	$6s\ {}^2S$	0½	0	
$^2D_3$	$5d^9\ 6s^2$	$6s^2\ {}^2D$	2½	35514	−15038
$^2D_2$			1½	50552	
2P₁	$5d^{10}(^1S)6p$	$6p\ {}^2P^{\circ}$	0½	*51485*	9123
2P₂			1½	*60608*	

Hg II

Author	Config.	Desig.	J	Level	Interval
$1_{2½}$	$5d^9_{2½}\ 6s_{0½}\ 6p_{0½}$		2½	*79704*	
$2_{3½}$	"		3½	*84809*	
$3_{2½}$	"		2½	*84834*	
$4_{1½}$	"		1½	*86177*	

Hg II—Continued

Author	Config.	Desig.	J	Level	Interval
$5_{2½}$	$5d^9_{2½}\ 6s_{0½}\ 6p_{1½}$		4½	93566?	
$6_{1½}$	"		1½	94091	
$7_{2½}$	"		3½	95186	
$8_{2½}$	"		2½	95302	
2S	$5d^{10}(^1S)7s$	$7s\ ^2S$	0½	95714	
$9_{1½}$	$5d^9_{1½}\ 6s_{0½}\ 6p_{1½}$		0½	96185	
$10_{2½}$	"		2½	97094	
11°	$5d^9_{1½}\ 6s_{0½}\ 6p_{0½}$?		1½?	100859	
$12_{1½}$	"		1½	103183	
Z	"	$^2P°$	0½	103870	
14°	"		2½?	104036	
$3D_2$ $3D_3$	$5d^{10}(^1S)6d$	$6d\ ^2D$	1½ 2½	104983 105543	560
Y		$^2P°$	1½	106086	
16°			3½	106213	
U	$5d^9_{1½}\ 6s_{0½}\ 6p_{1½}$	$^2P°$	0½	106293	
$^4\bar{D}_{½}$	$5d^9_{1½}\ 6s_{0½}\ 6p_{1½}$		0½	106612	
$18_{1½}$			1½	106714	
$3P_1$ $3P_2$	$5d^{10}(^1S)7p$	$7p\ ^2P°$	0½ 1½	108298 111970	3672
$20_{2½}$			3½	108974	
X	$5d^9_{1½}\ 6s_{0½}\ 6p_{1½}$	$^2P°$	1½	109189	
$22_{1½}$	$5d^9_{1½}\ 6s_{0½}\ 6p_{1½}$		1½	110603	
$^4D°_{3½}$			3½	110846	
$23_{2½}$	$5d^9_{1½}\ 6s_{0½}\ 6p_{1½}$		3½	111172	
$^4D°_{2½}$			2½	116200	
$^4D°_{1½}$			1½	117339	
$^4D°_{½}$			0½	119447	
3S	$5d^{10}(^1S)8s$	$8s\ ^2S$	0½	121416	
C		$^2F°$	2½	121960	
B			1½	122186	
$4F_4$ $4F_3$	$5d^{10}(^1S)5f$	$5f\ ^2F°$	3½ 2½	123152 123409	−257
$4D_2$ $4D_3$	$5d^{10}(^1S)7d$	$7d\ ^2D$	1½ 2½	125324 125578	254
$4P_1$ $4P_2$	$5d^{10}(^1S)8p$	$8p\ ^2P°$	0½ 1½	126942 127795	853
4S	$5d^{10}(^1S)9s$	$9s\ ^2S$	0½	132559	
$4D°_{3½}$			3½	132714	
$5F_4$ $5F_3$	$5d^{10}(^1S)6f$	$6f\ ^2F°$	3½ 2½	133267.5 133350	−82
5G	$5d^{10}(^1S)5g$	$5g\ ^2G$	3½, 4½	133653	

Hg II—Continued

Author	Config.	Desig.	J	Level	Interval
$5D_2$ $5D_3$	$5d^{10}(^1S)8d$	$8d\ ^2D$	1½ 2½	134562 134698	136
$3_{2½}$			3½	135299	
$5P_1$ $5P_2$	$5d^{10}(^1S)9p$	$9p\ ^2P°$	0½ 1½	135467 135829	362
A			2½	136266	
$4_{2½}$			2½	136712	
5S	$5d^{10}(^1S)10s$	$10s\ ^2S$	0½	138434	
$6F_4$ $6F_3$	$5d^{10}(^1S)7f$	$7f\ ^2F°$	3½ 2½	138793 138812	−19
6G	$5d^{10}(^1S)6g$	$6g\ ^2G$	3½, 4½	139042.4	
$6D_2$ $6D_3$	$5d^{10}(^1S)9d$	$9d\ ^2D$	1½ 2½	139627 139695	68
$6P_1$ $6P_2$	$5d^{10}(^1S)10p$	$10p\ ^2P°$	0½ 1½	140128 140329	201
$5_{2½}$			2½	140135	
6S	$5d^{10}(^1S)11s$	$11s\ ^2S$	0½	141914.5	
$7F_4$ $7F_3$	$5d^{10}(^1S)8f$	$8f\ ^2F°$	3½ 2½	142127.3 142130.7	−3.4
7G	$5d^{10}(^1S)7g$	$7g\ ^2G$	3½, 4½	142293.4	
$7D_2$ $7D_3$	$5d^{10}(^1S)10d$	$10d\ ^2D$	1½ 2½	142660 142709.5	150
$7P_1$ $7P_2$	$5d^{10}(^1S)11p$	$11p\ ^2P°$	0½ 1½	142959 143117	158
7S	$5d^{10}(^1S)12s$	$12s\ ^2S$	0½	144150	
$8F_3$ $8F_4$	$5d^{10}(^1S)9f$	$9f\ ^2F°$	2½ 3½	144289 144290	1
8G	$5d^{10}(^1S)8g$	$8g\ ^2G$	3½, 4½	144401.7	
$8D_2$ $8D_3$	$5d^{10}(^1S)11d$	$11d\ ^2D$	1½ 2½	144653.2 144679.6	26.4
$4D°_{½}$			0½	144910	
$9F_4$ $9F_3$	$5d^{10}(^1S)10f$	$10f\ ^2F°$	3½ 2½	145768 145769	−1
9G	$5d^{10}(^1S)9g$	$9g\ ^2G$	3½, 4½	145847.35	
9H	$5d^{10}(^1S)9h$	$9h\ ^2H°$	4½, 5½	145849	
$9D_2$ $9D_3$	$5d^{10}(^1S)12d$	$12d\ ^2D$	1½ 2½	146025.6 146053	27
$a_{5/2}$			2½	146647	
10G	$5d^{10}(^1S)10g$	$10g\ ^2G$	3½, 4½	146880.4	
10H	$5d^{10}(^1S)10h$	$10h\ ^2H°$	4½, 5½	146882	
$10D_2$ $10D_3$	$5d^{10}(^1S)13d$	$13d\ ^2D$	1½ 2½	147014 147035	21
11G	$5d^{10}(^1S)11g$	$11g\ ^2G$	3½, 4½	147645.0	
$12D_2$	$5d^{10}(^1S)15d$	$15d\ ^2D$	1½ 2½	148311	
$13D_2$	$5d^{10}(^1S)16d$	$16d\ ^2D$	1½ 2½	148743	
	Hg III $(^1S_0)$	*Limit*		151280	

February 1958.

Hg III

(Pt I sequence; 78 electrons) $Z=80$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,4f^{14}\,5s^2\,5p^6\,5d^{10}\;{}^1S_0$

$5d^{10}\;{}^1S_0$ 276000±K I. P. 34.2 volts

Foster has revised the earlier work on this spectrum by Johns and others, added 13 new levels, and published a list of 99 classified lines between 610.46 A and 8151.64 A. The energy levels in the table are quoted from his paper. He has reobserved the spectrum from 2240 A to 10000 A, by means of an electrodeless discharge, and utilized measurements by others in the short-wave region for transitions between terms otherwise well established. His interpretation is supported by observations of isotope shifts.

Johns has published a list of nearly 500 classified lines between 570.91 A and 8451.1 A, attributed to Hg III, and 41 levels not reported by Foster. Most of the additional levels are assigned to the $5d^9\,6,7d$; $5d^9\,8s$; $5d^9\,7p$; and $5d^9\,5f$ configurations. This more extensive list needs further confirmation because some of the lines may not belong to the Hg III spectrum. Nevertheless, "a large part of the analysis as presented by Johns is confirmed . . .."

The spectra of the Pt I isoelectronic sequence are of special theoretical interest because they approach *jj*-coupling rather than *LS*-coupling. This appears more conspicuously in the spectra of higher ionization especially among the levels from the $5d^9(^2D)6p$ configuration. A detailed study of "The Four Vector Problem and Its Application to Energies and Intensities in Platinum-like Spectra" has been made by Goble. In *LS*-coupling this configuration gives rise to the terms $^{1,3}(P^\circ D^\circ F^\circ)$. In *jj*-coupling the same number of energy levels and the same resultant *J*-values occur, but each level is defined by two *j*-values, one for the *d*-electron (1½ or 2½), and one for the *p*-electron (0½ or 1½). The *j*-values for the *d*- and *p*-electrons, as required for *jj*-coupling, are indicated in the configuration column, the former being the same as the *J*-values of the limit term ^2D.

In the table the writer has arranged the levels in numerical order and retained in the left column the arbitrary numbers used by the authors to designate the various levels. She has assigned *LS*-designations in the case of the $^{1,3}D$ terms from the $5d^9(^2D)ns$ configuration, although the *jj*-coupling applies here also.

Foster adopts *jj*-coupling notation for the levels having the configuration $5d^8\,6s^2$, assigning the first group of three levels (J=4, 2, 0) to "$5d^8_{5/2,5/2}\,6s^2$", the next group of four (J=3, 2, 1, 4) to "$5d^8_{5/2,3/2}\,6s^2$", and the last group of two (J=2, 0) to "$5d^8_{3/2,3/2}\,6s^2$". A table giving the transformation from *jj*- to *LS*-coupling may be found in the book by Condon and Shortley, p. 294.

Johns states that the limit is approximately 276000, which is quoted here. Mack and Fromer derive the value 34.3 ±0.3 from a Moseley diagram for the sequence. In making the diagram they used a Rydberg formula for the first two members of the $5d^9(^2D_{2½})ns$ series, J=3, and applied the same Ritz correction as for the Au I-like spectrum of the same stage of ionization.

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Hg III

Author	Config.	Desig.	J	Level	Author	Config.	Desig.	J	Level
1_0	$5d^{10}$	$5d^{10}\ ^1S$	0	0.0	51°_1	$5d^8\ 6s\ 6p$		1	*158885.8*
2_3	$5d^9(^2D_{2\frac{1}{2}})6s$	$6s\ ^3D$	3	42850.3	14_0	$5d^8\ 6s^2$	$6s^2\ ^1S$	0	158909.0
3_2	$5d^9(^2D_{2\frac{1}{2}})6s$	$6s\ ^3D$	2	46029.5	52°_2	$5d^8\ 6s\ 6p$		2	*159861.4*
4_1	$5d^9(^2D_{1\frac{1}{2}})6s$	$6s\ ^3D$	1	58405.8	53°_3	$5d^8\ 6s\ 6p$		3	*160015.7*
5_2	$5d^9(^2D_{1\frac{1}{2}})6s$	$6s\ ^1D$	2	61085.7	54°_1	$5d^8\ 6s\ 6p$		1	*160170.0*
6_4	$5d^8\ 6s^2$	$6s^2\ ^3F$	4	97893.8	23°_2	$5d^8\ 6s\ 6p$		2	*160789.3*
1°_2	$5d^9(^2D_{2\frac{1}{2}})6p_{\frac{1}{2}}$		2	*103549.4*	55°_1	$5d^8\ 6s\ 6p$		1	*160920.9*
2°_3	$5d^9(^2D_{2\frac{1}{2}})6p_{\frac{1}{2}}$		3	*105697.8*	24°_4	$5d^8\ 6s\ 6p$		4	*161282.2?*
7_2	$5d^8\ 6s^2$		2	106027.5	25°_2	$5d^8\ 6s\ 6p$		2	*161431.4*
9_3	$5d^8\ 6s^2$		3	112226.0	26°_3	$5d^8\ 6s\ 6p$		3	*161461.2*
5°_4	$5d^9(^2D_{2\frac{1}{2}})6p_{1\frac{1}{2}}$		4	*117994.5*	27°_4	$5d^8\ 6s\ 6p$		4	*162155.0?*
3°_2	$5d^9(^2D_{2\frac{1}{2}})6p_{1\frac{1}{2}}$		2	*118548.0*	28°_2	$5d^8\ 6s\ 6p$		2	*162972.2*
4°_1	$5d^9(^2D_{1\frac{1}{2}})6p_{\frac{1}{2}}$		1	*118607.4*	29°_4	$5d^8\ 6s\ 6p$		4	*163451.4*
11_2	$5d^8\ 6s^2$		2	118926.5	56°_1	$5d^8\ 6s\ 6p$		1	*163818.2*
6°_2	$5d^9(^2D_{1\frac{1}{2}})6p_{\frac{1}{2}}$		2	*120927.8*	30°_2	$5d^8\ 6s\ 6p$		2	*164905.3*
7°_3	$5d^9(^2D_{2\frac{1}{2}})6p_{1\frac{1}{2}}$		3	*121602.0*	31°_3	$5d^8\ 6s\ 6p$		3	*165004.8?*
8_0	$5d^8\ 6s^2$		0	122661.0	32°_3	$5d^8\ 6s\ 6p$		3	*166179.4*
10_1	$5d^8\ 6s^2$		1	122734.9	33°_2	$5d^8\ 6s\ 6p$		2	*166311.1*
12_4	$5d^8\ 6s^2$		4	126468.3	34°_3	$5d^8\ 6s\ 6p$		3	*167580.3*
8°_1	$5d^9(^2D_{2\frac{1}{2}})6p_{1\frac{1}{2}}$		1	*126556.3*	35°_3	$5d^8\ 6s\ 6p$		3	*169063.0*
9°_0	$5d^9(^2D_{1\frac{1}{2}})6p_{1\frac{1}{2}}$		0	*130702.4*	36°_3	$5d^8\ 6s\ 6p$		3	*169666.8*
13_2	$5d^8\ 6s^2$		2	133731.5	37°_3	$5d^8\ 6s\ 6p$		3	*171366.7?*
10°_3	$5d^9(^2D_{1\frac{1}{2}})6p_{1\frac{1}{2}}$		3	*134588.0*	57°_3	$5d^8\ 6s\ 6p$		3	*171700.6*
11°_1	$5d^9(^2D_{1\frac{1}{2}})6p_{1\frac{1}{2}}$		1	*134998.7*	38°_2	$5d^8\ 6s\ 6p$		2	*173968.5*
12°_2	$5d^9(^2D_{1\frac{1}{2}})6p_{1\frac{1}{2}}$		2	*136479.0*	39°_2	$5d^8\ 6s\ 6p$		2	*175512.0*
47°_1	$5d^8\ 6s\ 6p$		1	*147142.4*	40°_2	$5d^8\ 6s\ 6p$		2	*177281.0*
48°_3	$5d^8\ 6s\ 6p$		3	*148426.0*	15_3	$5d^9(^2D_{2\frac{1}{2}})7s$		3	178428.2
13°_3	$5d^8\ 6s\ 6p$		3	*149717.3*	16_2	$5d^9(^2D_{2\frac{1}{2}})7s$		2	179039.1
14°_4	$5d^8\ 6s\ 6p$		4	*150276.0?*	41°_2	$5d^8\ 6s\ 6p$		2	*180246.8*
15°_1	$5d^8\ 6s\ 6p$		1	*150278.7*	42°_3	$5d^8\ 6s\ 6p$		3	*183544.2*
16°_1	$5d^8\ 6s\ 6p$		1	*150857.0*	43°_3	$5d^8\ 6s\ 6p$		3	*184698.4*
17°_1	$5d^8\ 6s\ 6p$		1	*151997.5*	44°_3	$5d^8\ 6s\ 6p$		3	*187028.5*
18°_2	$5d^8\ 6s\ 6p$		2	*153254.6?*	27_1	$5d^9(^2D_{1\frac{1}{2}})7s$		1	194078.6
19°_3	$5d^8\ 6s\ 6p$		3	*154213.9*	28_2	$5d^9(^2D_{1\frac{1}{2}})7s$		2	194476.0
49°_3	$5d^8\ 6s\ 6p$		3	*154717.9*	45°_2	$5d^8\ 6s\ 6p$		2	*194904.0*
20°_3	$5d^8\ 6s\ 6p$		3	*155796.1*	46°_2	$5d^8\ 6s\ 6p$		2	*196377.9*
21°_3	$5d^8\ 6s\ 6p$		3	*156580.0*					
50°_2	$5d^8\ 6s\ 6p$		2	*157877.2*		Hg IV($^2D_{2\frac{1}{2}}$)	*Limit*	-------	276000
22°_2	$5d^8\ 6s\ 6p$		2	*158204.9*					

September 1954.

Hg IV

(Ir I sequence; 77 electrons) $Z=80$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^9\ {}^2D_{2\frac{1}{2}}$

$5d^9\ {}^2D_{2\frac{1}{2}}$ K I. P. volts

The spectrum needs further study. By analogy with related spectra the ground level of Hg IV is predicted with certainty to be $5d^9\ {}^2D_{2\frac{1}{2}}$, as has been pointed out by Edlén. The analysis is from Subbaraya, who has classified about 200 lines between 938 A and 7517 A from wavelength measurements by Caroll, Bloch, Déjardin, and Ricard. A homogeneous line list containing accurate wavelengths is needed to confirm and extend the present work, since the limit of tolerance within the multiplets is inexcusably large.

No series are known. The doublet and quartet terms are connected by observed intersystem combinations.

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Hg IV

Author	Config.	Desig.	J	Level	Interval
1	$5d^8(^3F)6s$	$6s\ ^4F$	4½	0	
					−7557
4			3½	7557	
					−4527
9			2½	12084	
					−3354
10			1½	15438	
2	$5d^9$	$5d^9\ ^2D$	2½	2192	
					−8184
7			1½	10376	
3	$5d^7\ 6s^2$	$6s^2\ ^4F$	4½	5653	
					−2244
5			3½	7897	
					−1579
6			2½	9476	
					−1116
8			1½	10592	
11	$5d^8(^3P)6s$	$6s'\ ^4P$	2½	21011	
					−2259
12			1½	23270	
					−1294
14			0½	24564	
13	$5d^7\ 6s^2$	$6s^2\ ^4P$	2½	24054	
					−947
15			1½	25001	
					−801
16			0½	25802	
17			4½	42131	
18			2½, 3½	44599	
19			3½	53342	
20			3½	55664	
21			2½	57122	
22			3½	57270	
23			3½	59490	
1°	$5d^8(^3F)6p$	$6p\ ^4F°$	4½	*70567*	
					−5088
5°			3½	*75655*	
					−4033
9°			2½	*79688*	
					−3196
12°			1½	*82884*	
2°	$5d^8(^3F)6p$	$6p\ ^4G°$	5½	*74419*	
					−6620
11°			4½	*81039*	
					−6786
17°			3½	*87825*	
					−4412
22°			2½	*92237*	

Hg IV

Author	Config.	Desig.	J	Level	Interval
3°			3½	*74708*	
4°			3½	*75888*	
6°			2½	*75772*	
7°			3½	*77045*	
8°			3½	*78556*	
10°			3½	*79919*	
13°	$5d^8(^3F)6p$	$6p\ ^4D°$	3½	*85056*	
					−3160
18°			2½	*88216*	
					−1297
19°			1½	*89513*	
					−814
20°			0½	*90327*	
14°			2½	*85091*	
15°			3½	*86380*	
16°			1½, 2½	*87185*	
21°			2½	*91752*	
23°			1½, 2½	*101886*	
24°			2½	*102255*	
25°			2½	*102353*	
26°			1½, 2½	*106210*	
27°			2½	*106385*	
28°			1½	*106748*	
29°			1½, 2½	*108798*	
30°			2½	*113648*	
31°			2½	*114508*	

February 1958.

Hg IV Observed Terms*

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}$ $4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6+$	Observed Terms	
$5d^9$	$5d^9\ ^2D$	
$5d^7\ 6s^2$	$6s^2\ ^4P$ $6s^2\ ^4F$	
	$ns\ (n \geq 6)$	$np\ (n \geq 6)$
$5d^8(^3F)ns$	$6s\ ^4F$	$6p\ ^4D°$ $6p\ ^4F°$ $6p\ ^4G°$
$5d^8(^3P)ns'$	$6s'\ ^4P$	

*For predicted terms in the spectra of the Ir I isoelectronic sequence, see Vol. III, Introduction.

THALLIUM

Tl I

81 electrons $Z=81$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,4f^{14}\,5s^2\,5p^6\,5d^{10}\,6s^2\,6p\ ^2P^\circ_{1/2}$

$6p\ ^2P^\circ_{1/2}$ *49264.2* K I. P. 6.106 volts

The analysis is chiefly from Fowler and Paschen-Götze, but some terms have been added from later papers. Meggers and Murphy have observed Tl I in the near infrared and added the terms 7, $8f\ ^2F^\circ$. Beutler and Demeter have observed in absorption, ultraviolet combinations with the ground state giving the terms $ns\ ^2S$ ($n=8$ to 20) and $nd\ ^2D$ ($n=6$ to 23), thus extending the former series by one member, and the latter by five. For the ^2D series they have observed only the level with $J=1\frac{1}{2}$, but for $n>12$ these terms are listed in the table as unresolved. They give, also, the levels $^4P_{0\frac{1}{2},1\frac{1}{2}}$, $^2D_{1\frac{1}{2}}$, and $^2P_{0\frac{1}{2}}$ from the $6p^2$ configuration. Clearman has measured 13 Tl I lines, adding the component $6p^2\ ^4P_{0\frac{1}{2}}$ and the levels labeled 2° and 3° in the table.

The writer has utilized the later observations to improve as many values of the Tl I energy levels as possible. For levels above the ionization limit, rounded off values are tabulated.

Beutler and Demeter list, also, 9 lines observed between 651.42 A and 891 A (153510 K and 112250 K, respectively). They suggest that these lines are probably due to the transitions involving configurations $5d^{10}\,6s^2\,6p_{0\frac{1}{2}}$–$5d^9\,6s^2\,6p_{0\frac{1}{2}}\,np$ (or possibly nf).

There are approximately 160 classified lines extending from 651 A to 51057 A, including a number of forbidden combinations. The observations by various authors do not yield precise term values even though the analysis is essentially complete. The spectrum exhibits hyperfine structure and isotope shift, and several papers deal with Paschen-Back effect and the Zeeman effect of hyperfine structure. Only a limited number of references to these topics is included below. Back and Wulff report the hyperfine structure separation of the ground level as 0.708K.

The series are long and well established. The limit quoted here is from Fowler. Beutler and Demeter state that the term $10s\ ^2S$ is perturbed because its combination with the ground state is affected by a neighboring line classified as $6p\ ^2P^\circ_{0\frac{1}{2}}-6p^2\ ^4P_{0\frac{1}{2}}$. This is based on their study of the series fitted to a Rydberg-Ritz formula.

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Tl I

Config.	Desig.	J	Level	Interval
$6s^2(^1S)6p$	$6p\ ^2P^\circ$	$0\frac{1}{2}$ $1\frac{1}{2}$	*0.0* *7792.7*	7792.7
$6s^2(^1S)7s$	$7s\ ^2S$	$0\frac{1}{2}$	26477.5	
$6s^2(^1S)7p$	$7p\ ^2P^\circ$	$0\frac{1}{2}$ $1\frac{1}{2}$	*34159.9* *35161.1*	1001.2
$6s^2(^1S)6d$	$6d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	36117.9 36199.9	82.0
$6s^2(^1S)8s$	$8s\ ^2S$	$0\frac{1}{2}$	38745.9	
$6s^2(^1S)8p$	$8p\ ^2P^\circ$	$0\frac{1}{2}$ $1\frac{1}{2}$	*41368.1* *41740.8*	372.7
$6s^2(^1S)7d$	$7d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	42011.4 42049.0	37.6
$6s^2(^1S)5f$	$5f\ ^2F^\circ$	$2\frac{1}{2}, 3\frac{1}{2}$	*42318.4*	
$6s^2(^1S)9s$	$9s\ ^2S$	$0\frac{1}{2}$	43166.2	
$6s^2(^1S)9p$	$9p\ ^2P^\circ$	$0\frac{1}{2}$ $1\frac{1}{2}$	*44380.9* *44562.5*	181.6
$6s^2(^1S)8d$	$8d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	44672.6 44692.7	20.1
$6s^2(^1S)6f$	$6f\ ^2F^\circ$	$2\frac{1}{2}, 3\frac{1}{2}$	*44823.5*	
$6s\ 6p^2$	$6p^2\ ^4P$	$0\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$	45220 49800 53050	4580 3250
$6s^2(^1S)10s$	$10s\ ^2S$	$0\frac{1}{2}$	45296.8	
$6s^2(^1S)10p$	$10p\ ^2P^\circ$	$0\frac{1}{2}$ $1\frac{1}{2}$	*45939.3* *46043.6*	104.3
$6s^2(^1S)9d$	$9d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	46098.5 46110.3	*11.8*
$6s^2(^1S)7f$	$7f\ ^2F^\circ$	$2\frac{1}{2}, 3\frac{1}{2}$	*46185.3*	
$6s^2(^1S)11s$	$11s\ ^2S$	$0\frac{1}{2}$	46456.9	
$6s^2(^1S)11p$	$11p\ ^2P^\circ$	$0\frac{1}{2}$ $1\frac{1}{2}$	*46853.8* *46917.1*	63.3
$6s^2(^1S)10d$	$10d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	46949.9 46958.0	8.1
$6s^2(^1S)8f$	$8f\ ^2F^\circ$	$2\frac{1}{2}, 3\frac{1}{2}$	*47004.6*	
$6s^2(^1S)12s$	$12s\ ^2S$	$0\frac{1}{2}$	47178.9	
$6s^2(^1S)12p$	$12p\ ^2P^\circ$	$0\frac{1}{2}$ $1\frac{1}{2}$	*47442.6* *47477.4*	34.8
$6s^2(^1S)11d$	$11d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	47499.8 47504.1	4.3?
$6s^2(^1S)13s$	$13s\ ^2S$	$0\frac{1}{2}$	47654.7	
$6s^2(^1S)13p$	$13p\ ^2P^\circ$	$0\frac{1}{2}, 1\frac{1}{2}$	*47847.7*	
$6s^2(^1S)12d$	$12d\ ^2D$	$1\frac{1}{2}, 2\frac{1}{2}$	47876.0	
$6s^2(^1S)14s$	$14s\ ^2S$	$0\frac{1}{2}$	47983.2	
$6s^2(^1S)14p$	$14p\ ^2P^\circ$	$0\frac{1}{2}, 1\frac{1}{2}$	*48129.6*	
$6s^2(^1S)13d$	$13d\ ^2D$	$1\frac{1}{2}, 2\frac{1}{2}$	48142.3	
$6s^2(^1S)15s$	$15s\ ^2S$	$0\frac{1}{2}$	48223.2	
$6s^2(^1S)15p$	$15p\ ^2P^\circ$	$0\frac{1}{2}, 1\frac{1}{2}$	*48331.2*	
$6s^2(^1S)14d$	$14d\ ^2D$	$1\frac{1}{2}, 2\frac{1}{2}$	48339.3	
$6s^2(^1S)16s$	$16s\ ^2S$	$0\frac{1}{2}$	48399.5	
$6s^2(^1S)16p$	$16p\ ^2P^\circ$	$0\frac{1}{2}, 1\frac{1}{2}$	*48459.5*	
$6s^2(^1S)15d$	$15d\ ^2D$	$1\frac{1}{2}, 2\frac{1}{2}$	48488.6	
$6s^2(^1S)17s$	$17s\ ^2S$	$0\frac{1}{2}$	48534.8	
$6s^2(^1S)16d$	$16d\ ^2D$	$1\frac{1}{2}, 2\frac{1}{2}$	48604.0	
$6s^2(^1S)18s$	$18s\ ^2S$	$0\frac{1}{2}$	48639.0	
$6s^2(^1S)17d$	$17d\ ^2D$	$1\frac{1}{2}, 2\frac{1}{2}$	48696.5	
$6s^2(^1S)19s$	$19s\ ^2S$	$0\frac{1}{2}$	48726.2	
$6s^2(^1S)18d$	$18d\ ^2D$	$1\frac{1}{2}, 2\frac{1}{2}$	48770.5	
$6s^2(^1S)20s$	$20s\ ^2S$	$0\frac{1}{2}$	48796.2	
$6s^2(^1S)19d$	$19d\ ^2D$	$1\frac{1}{2}, 2\frac{1}{2}$	48828.6	
$6s^2(^1S)20d$	$20d\ ^2D$	$1\frac{1}{2}, 2\frac{1}{2}$	48878.2	
$6s^2(^1S)21d$	$21d\ ^2D$	$1\frac{1}{2}, 2\frac{1}{2}$	48920.6	
$6s^2(^1S)22d$	$22d\ ^2D$	$1\frac{1}{2}, 2\frac{1}{2}$	48957.7	
$6s^2(^1S)23d$	$23d\ ^2D$	$1\frac{1}{2}, 2\frac{1}{2}$	48988.8	
Tl II ($^1S_0$)	*Limit*	-------	*49264.2*	
$6s\ 6p^2$	$6p^2\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	62000	
$6s\ 6p^2$	$6p^2\ ^2P$	$0\frac{1}{2}$ $1\frac{1}{2}$	67150	
$6s\ 6p(^3P)7s$	2°		*75970*	
	3°	$1\frac{1}{2}$	*96740*	

January 1955.

Tl I OBSERVED TERMS*

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^{10}+$	Observed Terms			
$6s^2(^1S)6p$	$6p\ ^2P^\circ$			
$6s\ 6p^2$	$6p^2\ ^4P$ $6p^2\ ^2P$ $6p^2\ ^2D$			
	$ns\ (n\geq 7)$	$np\ (n\geq 7)$	$nd\ (n\geq 6)$	$nf\ (n\geq 5)$
$6s^2(^1S)nx$	7 to $20s\ ^2S$	7 to $16p\ ^2P^\circ$	6 to $23d\ ^2D$	5 to $8f\ ^2F^\circ$

*For predicted terms in the spectra of the Tl I isoelectronic sequence, see Vol. III, Introduction.

Tl II

(Hg I sequence; 80 electrons) $Z=81$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^{10}\ 6s^2\ ^1S_0$

$6s^2\ ^1S_0$ 164765±5 K I. P. 20.42 volts

Ellis and Sawyer have revised the early work on Tl II and almost doubled the number of classified lines by observing the spectrum with a hollow cathode source, from 639.08 A to 9254 A. The total number of classified lines is 247.

Hyperfine structure affects many of the lines and has been resolved by various investigators, including Smith, McLennan and Crawford, and others.

The Zeeman and Paschen-Back effects have also been observed for a few selected lines.

Perturbations in the series are discussed by Ellis and Sawyer. They derive the limit quoted above from the $ns\ ^3S$ and $nd\ ^3D$ series, $n=7$ to 12 and 6 to 11, respectively. A plot of the quantum defects for each of the series shows that they are unperturbed, according to these authors.

Observed intersystem combinations connect the singlet and triplet systems of terms.

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Tl II

Config.	Desig.	J	Level	Interval
$5d^{10}\ 6s^2$	$6s^2\ ^1S$	0	0	
$5d^{10}\ 6s(^2S)6p$	$6p\ ^3P^\circ$	0	*49451*	2942
		1	*52393*	9332
		2	*61725*	
$5d^{10}\ 6s(^2S)6p$	$6p\ ^1P^\circ$	1	*75660*	
$5d^{10}\ 6s(^2S)7s$	$7s\ ^3S$	1	105225	
$5d^{10}\ 6s(^2S)7s$	$7s\ ^1S$	0	107996	
$5d^9\ 6s^2(^2D)6p$	1°	2	*110387*	
$5d^{10}\ 6s(^2S)6d$	$6d\ ^1D$	2	115160	

Tl II

Config.	Desig.	J	Level	Interval
$5d^{10}\ 6s(^2S)6d$	$6d\ ^3D$	1	116147	283
		2	116430	396
		3	116826	
$5d^{10}\ 6p^2$	$6p^2\ ^3P$	0	117408	7930
		1	125338	3479
		2	128817	
$5d^{10}\ 6s(^2S)7p$	$7p\ ^3P^\circ$	0	*119361*	215
		1	*119576*	2453
		2	*122029*	
$5d^{10}\ 6s(^2S)7p$	$7p\ ^1P^\circ$	1	*122379*	
$5d^9\ 6s^2(^2D)6p$	4°	2	*125437*	
$5d^9\ 6s^2(^2D)6p$	5°	1	*126804*	

Tl II—Continued

Config.	Desig.	J	Level	Interval
$5d^9\ 6s^2(^2D)6p$	$6°$	3	*128663*	
$5d^9\ 6s^2(^2D)6p$	$7°$	2	*129158*	
$5d^{10}\ 6s(^2S)8s$	$8s\ ^3S$	1	133568	
$5d^{10}\ 6s(^2S)8s$	$8s\ ^1S$	0	134292	
$5d^9\ 6s^2(^2D)6p$	$8°$	1	*134362*	
$5d^{10}\ 6s(^2S)5f$	$5f\ ^3F°$	2 3 4	*136216* *136115* *136230*	−101 115
$5d^{10}\ 6s(^2S)5f$	$5f\ ^1F°$	3	*136263*	
$5d^{10}\ 6s(^2S)7d$	$7d\ ^1D$	2	136891	
$5d^{10}\ 6s(^2S)7d$	$7d\ ^3D$	1 2 3	137927 138053 138203	126 150
$5d^{10}\ 6s(^2S)8p$	$8p\ ^3P°$	0 1 2	 *139365* *140304*	939
$5d^{10}\ 6s(^2S)8p$	$8p\ ^1P°$	1	*141000*	
$5d^{10}\ 6p^2$	$6p^2\ ^1D$	2	141982	
$5d^9\ 6s^2(^2D)6p$	$10°$	3	*142781*	
$5d^9\ 6s^2(^2D)6p$	$11°$	1	*143618*	
$5d^9\ 6s^2(^2D)6p$	$12°$	2	*145098*	
$5d^{10}\ 6s(^2S)9s$	$9s\ ^3S$	1	145415	
$5d^{10}\ 6s(^2S)9s$	$9s\ ^1S$	0	145591	
$5d^{10}\ 6s(^2S)6f$	$6f\ ^3F°$	4 3 2	*146500* *146534* *146523*	−34 11
$5d^{10}\ 6s(^2S)6f$	$6f\ ^1F°$	3	*146543*	
$5d^{10}\ 6s(^2S)5g$	$5g\ ^{1,3}G$	3, 4, 5	147065	
$5d^{10}\ 6s(^2S)8d$	$8d\ ^3D$	1 2 3	147602 147652 147747	50 95

December 1954.

Tl II—Continued

Config.	Desig.	J	Level	Interval
$5d^{10}\ 6s(^2S)9p$	$9p\ ^3P°$	0 1 2	 *148349* *148825*	476
$5d^{10}\ 6s(^2S)8d$	$8d\ ^1D$	2	148465	
$5d^{10}\ 6s(^2S)9p$	$9p\ ^1P°$	1	*149063*	
$5d^{10}\ 6s(^2S)10s$	$10s\ ^3S$	1	151568	
$5d^{10}\ 6s(^2S)7f$	$7f\ ^3F°$	2 3, 4	*152104* *152110*	6
$5d^{10}\ 6s(^2S)7f$	$7f\ ^1F°$	3	*152140*	
$5d^{10}\ 6s(^2S)6g$	$6g\ ^{1,3}G$	3, 4, 5	152470	
$5d^{10}\ 6s(^2S)9d$	$9d\ ^3D$	1 2 3	152819 152847 152906	28 59
$5d^{10}\ 6s(^2S)9d$	$9d\ ^1D$	2	153200	
$5d^{10}\ 6s(^2S)10p$	$10p\ ^3P°$	0 1 2	 *153530?*	
$5d^{10}\ 6s(^2S)10p$	$10p\ ^1P°$	1	*153633?*	
$5d^{10}\ 6s(^2S)11s$	$11s\ ^3S$	1	155181	
$5d^{10}\ 6s(^2S)10d$	$10d\ ^3D$	1 2 3	155963 155982 156018	19 36
$5d^{10}\ 6s(^2S)10d$	$10d\ ^1D$	2	156177	
$5d^{10}\ 6s(^2S)11p$	$11p\ ^1P°$	1	*156475?*	
$5d^{10}\ 6s(^2S)12s$	$12s\ ^3S$	1	157481	
$5d^{10}\ 6s(^2S)11d$	$11d\ ^3D$	1 2 3	 158027? 158038?	11
$5d^{10}\ 6s(^2S)11d$	$11d\ ^1D$	2	158136?	
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Tl III($^2S_{1/2}$)	*Limit*	----------	164765 ±5	

Tl II Observed Terms*

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6+$	Observed Terms		
$5d^{10}\ 6s^2$	$6s^2\ ^1S$		
$5d^{10}\ 6p^2$	$6p^2\ ^3P$ $6p^2\ ^1D$		
	$ns\ (n \geq 7)$	$np\ (n \geq 6)$	$nd\ (n \geq 6)$
$5d^{10}\ 6s(^2S)nx$	7 to $12s\ ^3S$ 7 to $9s\ ^1S$	6 to $10p\ ^3P°$ 6 to $11p\ ^1P°$	6 to $11d\ ^3D$ 6 to $11d\ ^1D$
	$nf\ (n \geq 5)$	$ng\ (n \geq 5)$	
$5d^{10}\ 6s(^2S)nx$	5 to $7f\ ^3F°$ 5 to $7f\ ^1F°$	5, $6g\ ^{1,3}G$	

*For predicted terms in the spectra of the Hg I isoelectronic sequence, see Vol. III, Introduction.

Tl III

(Au I sequence; 79 electrons) $Z=81$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,4f^{14}\,5s^2\,5p^6\,5d^{10}\,6s\;{}^2S_{0\frac{1}{2}}$

$6s\;{}^2S_{0\frac{1}{2}}$ **240600 K** I. P. 29.8 volts

The terms in the table are from McLennan, McLay, and Crawford (1929), who extended the work of Carroll. They list 22 classified lines between 1231.57 A and 5927.8 A and one at 8001 A. The analysis is seriously incomplete. The inverted ${}^2D$ term from $5d^9\,6s^2$, whose lower component should lie between $6p\;{}^2P^\circ$ levels and whose interval is approximately 18000, is not reported in this paper.

P. Pattabhiramayya and A. S. Rao include this term in the list of 2 doublet and 6 quartet terms, which they report as an extension to the above analysis. Their work brings the total of classified lines to 89, but their data are omitted here pending further confirmation. The discrepancies within the multiplets between the observed and calculated wave numbers indicate that more precise wavelengths are needed to extend the analysis.

Crooker describes the Paschen-Back effect observed for λ5362, $7s\;{}^2S_{0\frac{1}{2}}-7p\;{}^2P^\circ_{0\frac{1}{2}}$. The two 1930 papers by McLennan and his associates discuss the observed hyperfine structure and the observed Zeeman effects of the hyperfine structure components. They include among their classified lines one designation involving the level $5d^9\,6s^2\;{}^2D_{1\frac{1}{2}}$ and another involving the level $5d^9\,6s\,6p\;{}^2P^\circ_{1\frac{1}{2}}$. The respective new levels from these two lines are approximately 84595 and *155851*. More combinations are required to confirm them.

The limit derived from the first three members of the ${}^2S$ series by means of a Hicks formula is 240300. The authors have increased this value by 300 to give an effective total quantum number for $5g\;{}^2G$ that is nearly hydrogenic, i. e., 4.995.

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Tl III

Config.	Desig.	J	Level	Interval
$5d^{10}({}^1S)6s$	$6s\;{}^2S$	0½	0	
$5d^{10}({}^1S)6p$	$6p\;{}^2P^\circ$	0½ 1½	*64157* *78970*	14813
$5d^{10}({}^1S)7s$	$7s\;{}^2S$	0½	139209	
$5d^{10}({}^1S)6d$	$6d\;{}^2D$	1½ 2½	145355 146669	1314
$5d^{10}({}^1S)7p$	$7p\;{}^2P^\circ$	0½ 1½	*157852* *163534*	5682

Tl III

Config.	Desig.	J	Level	Interval
$5d^{10}({}^1S)5f$	$5f\;{}^2F^\circ$	3½ 2½	*175593* *176955*	−1362
$5d^{10}({}^1S)8s$	$8s\;{}^2S$	0½	183187	
$5d^{10}({}^1S)7d$	$7d\;{}^2D$	1½ 2½	186356 186948	592
$5d^{10}({}^1S)5g$	$5g\;{}^2G$	3½, 4½	201011	
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Tl IV $({}^1S_0)$	*Limit*	------	**240600**	

November 1954.

Tl IV

(Pt I sequence; 78 electrons) **Z=81**

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,4f^{14}\,5s^2\,5p^6\,5d^{10}\ {}^1S_0$

$5d^{10}\ {}^1S_0$ **409100 K** I. P. 50.7 volts

The analysis is from Mack and Fromer, who have revised and extended the earlier work of Rao and others. About 35 lines have been classified in the interval 531.260 A to 1974.6 A, and most of the results are based on observations by Arvidsson.

The spectra of the Pt I isoelectronic sequence are of special theoretical interest because they approach jj-coupling rather than LS- or Jl-coupling. This appears more conspicuously in the spectra of higher ionization, especially among the levels from the $5d^9(^2D)6p$ configuration. A detailed study of "The Four Vector Problem and Its Application to Energies and Intensities in Platinum-like Spectra" has been made by Goble. In LS-coupling this configuration gives rise to the terms $^{1,3}(P°D°F°)$. In jj-coupling the same number of energy levels and the same resultant J-values occur, but each level is defined by two j-values, one for the d-electron (1½ or 2½), and one for the p-electron (0½ or 1½).

In the table the writer has assigned LS-designations only in the case of the $^{1,3}D$ terms from the $5d^9(^2D)ns$ configuration, although the jj-coupling applies here, also. The j-values for the d- and p-electrons, as required for jj-coupling, are indicated in the configuration column, the former being the same as the J-values of the limit term ^2D. A table giving the transformation from jj- to LS-coupling may be found in the book by Condon and Shortley, p. 294.

The limit has been calculated by the writer from the ionization potential given by Mack and Fromer, which is obtained from a Moseley diagram for the sequence.

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Tl IV

Config.	Desig.	J	Level	Interval
$5d^{10}$	$5d^{10}\ {}^1S$	0	0	
$5d^9(^2D_{2½})6s$	$6s\ {}^3D$	3	75052	
		2	78647	−3595
$5d^9(^2D_{1½})6s$		1	93676	−15029
$5d^9(^2D_{1½})6s$	$6s\ {}^1D$	2	96727	
$5d^9(^2D_{2½})6p_{0½}$		2	*147636*	
$5d^9(^2D_{2½})6p_{0½}$		3	*149841*	
$5d^9(^2D_{1½})6p_{0½}$		2	*166425*	
$5d^9(^2D)6p$		1	*167499*	
$5d^9(^2D_{2½})6p_{1½}$		4	*167672*	

Tl IV

Config.	Desig.	J	Level	Interval
$5d^9(^2D_{2½})6p_{1½}$		2	*170334*	
$5d^9(^2D_{2½})6p_{1½}$		3	*172272*	
$5d^9(^2D)6p$		1	*175290*	
$5d^9(^2D_{1½})6p_{1½}$		0	*181083*	
$5d^9(^2D_{1½})6p_{1½}$		3	*187667*	
$5d^9(^2D_{1½})6p_{1½}$		1	*188233*	
$5d^9(^2D_{1½})6p_{1½}$		2	*190144*	
Tl V $(^2D_{2½})$	*Limit*	-------	[409100±]	

August 1954.

LEAD

Pb I

82 electrons $Z=82$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^{10}\ 6s^2\ 6p^2\ {}^3P_0$

$6p^2\ {}^3P_0$ 59821.0±0.5 K I. P. 7.415 volts

Giesseler and Grotrian have published the most extensive analysis of Pb I. Although series have long been recognized, the spectrum has needed more thorough study. Consequently, Meggers has reobserved the Pb I spectrum from 2000 A to 11360.0 A, and from 1614.73 A to 2000 A utilized spectrograms furnished by Shenstone. With an electrodeless ultra-high-frequency source he has measured some 355 lines in the interval 6560.77 A to longer waves. Of these, about 28 percent can be attributed to the known series.

The analysis has been revised and extended by Meggers for inclusion here, and some levels have been rearranged by the writer with the aid of the new observations in the long-wave region. There are approximately 240 classified lines to date, and very few observed lines between 1614 A and 6560 A remain unclassified. All level values have been revised on the basis of the new observations. The limit quoted by Bacher and Goudsmit has been verified by R. E. Trees by means of a Ritz formula applied to the $nd\ {}^3D_1^{\circ}$ series, $n=6$ to 20. Trees points out that this series is the one least likely to be perturbed.

The F-series are based chiefly on the evidence afforded by the Rydberg denominators. The *LS*-designations require further confirmation. They are included only to enable the user to identify the series for each *J*-value.

A number of tentative new levels that need further confirmation have been omitted from the table. They may belong to the configurations $6p^3$ or $6s\ 6p^2({}^4P)nx'$. Four lines observed by Randall between 12564 A and 15316 A can be classified from the known terms. More observations in the infrared beyond the photographic limit, are needed.

Numerous papers deal with the Zeeman effect, hyperfine structure, and intensities of forbidden lines. Only a few references to these are listed here. The observed *g*-values in the table are quoted from Back.

The large interval of the ground term ${}^2P^{\circ}$ in Pb II, 14081 K, results in a departure from *LS*-coupling in Pb I. Consequently, an arbitrary arrangement has been adopted in tabulating the levels. Pairs of related levels are listed together, with *LS*-designations indicating the series.

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Pb I

Config.	Desig.	J	Level	Interval	Obs. g
$6s^2\,6p^2$	$6p^2\ ^3P$	0	0.00	7819.35	0/0
		1	7819.35	2831.12	1.501
		2	10650.47		1.269
$6s^2\,6p^2$	$6p^2\ ^1D$	2	21457.90		1.230
$6s^2\,6p^2$	$6p^2\ ^1S$	0	29466.81		0/0
$6s^2\,6p(^2P_{1/2})7s$	$7s\ ^3P^\circ$	0	*34959.90*	327.34	0/0
		1	*35287.24*		1.349
$6s^2\,6p(^2P_{1/2})7p$	$7p\ ^3P$	1	42918.68	−1482.24	
		0	44400.92		
$6s^2\,6p(^2P_{1/2})7p$	$7p\ ^3D$	1	44675.00	134.41	
		2	44809.41		
$6s^2\,6p(^2P_{1/2})6d$	$6d\ ^3F^\circ$	2	*45443.26*	885.55	0.796
		3	*46328.81*		1.116
$6s^2\,6p(^2P_{1/2})6d$	$6d\ ^3D^\circ$	2	*46060.90*	−7.67	1.247
		1	*46068.57*		0.864
$6s^2\,6p(^2P_{1\frac{1}{2}})7s$	$7s\ ^3P^\circ$	2	*48188.67*	−1250.90	1.496
	$7s\ ^1P^\circ$	1	*49439.57*		1.131
$6s^2\,6p(^2P_{1/2})8s$	$8s\ ^3P^\circ$	1	*48686.87*	−39.29	1.304
		0	*48726.16*		0/0
$6s^2\,6p(^2P_{1/2})8p$	$8p\ ^3P$	1	51320.53	−465.37	
		0	51785.90		
$6s^2\,6p(^2P_{1/2})8p$	$8p\ ^3D$	1	51916.80	27.14	
		2	51943.94		
$6s^2\,6p(^2P_{1/2})7d$	$7d\ ^3F^\circ$	2	*52101.77*	310.5	
		3	*52412.3*		
$6s^2\,6p(^2P_{1/2})7d$	$7d\ ^3D^\circ$	2	*52311.37*	−188.16	
		1	*52499.53*		
$6s^2\,6p(^2P_{1/2})5f$	$5f\ ^3F$	2	52850.4		
		3			
$6s^2\,6p(^2P_{1/2})5f$	$5f\ ^1F$	3			
	$5f\ ^3F$	4	52857.81		
$6s^2\,6p(^2P_{1/2})9s$	$9s\ ^3P^\circ$	0	*53475.42*	35.82	
		1	*53511.24*		
$6s^2\,6p(^2P_{1/2})9p$	$9p\ ^3P$	1	54929.0	67.7	
		0	54861.29		
$6s^2\,6p(^2P_{1/2})8d$	$8d\ ^3F^\circ$	2	*55003.34*	139.88	
		3	*55143.22*		
$6s^2\,6p(^2P_{1/2})8d$	$8d\ ^3D^\circ$	2	*55084.20*	−74.05	
		1	*55158.25*		
$6s^2\,6p(^2P_{1/2})6f$	$6f\ ^1F$	3	55352.34	16.24	
	$6f\ ^3F$	4	55368.58		
$6s^2\,6p(^2P_{1/2})9p$	$9p\ ^3D$	1	55360.15	4.12	
		2	55364.27		
$6s^2\,6p(^2P_{1/2})6f$	$6f\ ^3F$	2	55377.52	108.68	
		3	55486.20		
$6s^2\,6p(^2P_{1/2})10s$	$10s\ ^3P^\circ$	0	*55706.24*	14.28	
		1	*55720.52*		
$6s^2\,6p(^2P_{1/2})9d$	$9d\ ^3F^\circ$	2	*56526.60*	74.14	
		3	*56600.74*		
$6s^2\,6p(^2P_{1/2})9d$	$9d\ ^3D^\circ$	2	*56563.29*	−41.54	
		1	*56604.83*		
$6s^2\,6p(^2P_{1/2})7f$	$7f\ ^1F$	3	56730.11	3.11	
	$7f\ ^3F$	4	56733.22		
$6s^2\,6p(^2P_{1/2})7f$	$7f\ ^3F$	2	56743.47	38.96	
		3	56782.43		
$6s^2\,6p(^2P_{1/2})11s$	$11s\ ^3P^\circ$	0	*56935.44*	6.82	
		1	*56942.26*		
$6s^2\,6p(^2P_{1/2})10p$	$10p\ ^3P$	1	57010.11		
		0			
$6s^2\,6p(^2P_{1\frac{1}{2}})7p$	$7p\ ^3D$	3	57371.75		
$6s^2\,6p(^2P_{1/2})10d$	$10d\ ^3F^\circ$	2	*57424.09*	45.31	
		3	*57469.40*		
$6s^2\,6p(^2P_{1/2})10d$	$10d\ ^3D^\circ$	2	*57444.55*	−26.69	
		1	*57471.24*		
$6s^2\,6p(^2P_{1/2})8f$	$8f\ ^1F$	3	57552.95	2.18	
	$8f\ ^3F$	4	57555.13		
$6s^2\,6p(^2P_{1/2})8f$	$8f\ ^3F$	2			
		3	57575.83		
$6s^2\,6p(^2P_{1/2})12s$	$12s\ ^3P^\circ$	0	*57684.5*	4.2	
		1	*57688.73*		
$6s^2\,6p(^2P_{1/2})11d$	$11d\ ^3F^\circ$	2	*57996.01?*	32.59	
		3	*58028.60*		
$6s^2\,6p(^2P_{1/2})11d$	$11d\ ^3D^\circ$	2	*58012.14?*	−17.88	
		1	*58030.02*		

Pb I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$6s^2\,6p(^2P^\circ_{1/2})9f$	$9f\ ^1F$	3	58086.22	1.64	
	$9f\ ^3F$	4	58087.86		
$6s^2\,6p(^2P^\circ_{1/2})9f$	$9f\ ^3F$	2			
		3	58101.28		
$6s^2\,6p(^2P^\circ_{1/2})13s$	$13s\ ^3P^\circ$	0			
		1	58179.3		
$6s^2\,6p(^2P^\circ_{1/2})12d$	$12d\ ^3F^\circ$	2			
		3	58409.44?		
$6s^2\,6p(^2P^\circ_{1/2})12d$	$12d\ ^3D^\circ$	2			
		1	58411.29		
$6s^2\,6p(^2P^\circ_{1/2})10f$	$10f\ ^1F$	3	58451.43?	1.20	
	$10f\ ^3F$	4	58452.63		
$6s^2\,6p(^2P^\circ_{1/2})14s$	$14s\ ^3P^\circ$	0			
		1	58517.67		
$6s^2\,6p(^2P^\circ_{1\frac{1}{2}})6d$	$6d\ ^3D^\circ$	3	58518.3		
$6s^2\,6p(^2P^\circ_{1/2})13d$	$13d\ ^3D^\circ$	2			
		1	58683.4		
$6s^2\,6p(^2P^\circ_{1/2})11f$	$11f\ ^1F$	3	58712.40		
	$11f\ ^3F$	4			
$6s^2\,6p(^2P^\circ_{1/2})15s$	$15s\ ^3P^\circ$	0			
		1	58761.0		
$6s^2\,6p(^2P^\circ_{1/2})14d$	$14d\ ^3D^\circ$	2			
		1	58882.4		
$6s^2\,6p(^2P^\circ_{1/2})16s$	$16s\ ^3P^\circ$	0			
		1	58941.8		
$6s^2\,6p(^2P^\circ_{1/2})15d$	$15d\ ^3D^\circ$	2			
		1	59034.3		
$6s^2\,6p(^2P^\circ_{1/2})17s$	$17s\ ^3P^\circ$	0			
		1	59080.4		
$6s^2\,6p(^2P^\circ_{1/2})16d$	$16d\ ^3D^\circ$	2			
		1	59151.3		
$6s^2\,6p(^2P^\circ_{1/2})17d$	$17d\ ^3D^\circ$	2			
		1	59244.9		
$6s^2\,6p(^2P^\circ_{1/2})18d$	$18d\ ^3D^\circ$	2			
		1	59320.4		
$6s^2\,6p(^2P^\circ_{1/2})19d$	$19d\ ^3D^\circ$	2			
		1	59382.1		
$6s^2\,6p(^2P^\circ_{1\frac{1}{2}})6d$	$6d\ ^3P^\circ$	1	59427.0?		
$6s^2\,6p(^2P^\circ_{1/2})20d$	$20d\ ^3D^\circ$	2			
		1	59432.5		
Pb II $(^2P^\circ_{1/2})$	*Limit*	..	**59821.0**		
$6s^2\,6p(^2P^\circ_{1\frac{1}{2}})8s$	$8s\ ^3P^\circ$	2	62620.9		
	$8s\ ^1P^\circ$	1			
$6s^2\,6p(^2P^\circ_{1\frac{1}{2}})8p$	$8p\ ^3D$	3	65751.51		
$6s^2\,6p(^2P^\circ_{1\frac{1}{2}})7d$	$7d\ ^3P^\circ$	1	65871.3?		
$6s^2\,6p(^2P^\circ_{1\frac{1}{2}})7d$	$7d\ ^3D^\circ$	3	66035.1		
$6s^2\,6p(^2P^\circ_{1\frac{1}{2}})9s$	$9s\ ^3P^\circ$	2	67481.6		
	$9s\ ^1P^\circ$	1			
$6s^2\,6p(^2P^\circ_{1\frac{1}{2}})8d$	$8d\ ^3P^\circ$	1	68925.5?		
$6s^2\,6p(^2P^\circ_{1\frac{1}{2}})8d$	$8d\ ^3D^\circ$	3	69749.8		
Pb II $(^2P^\circ_{1\frac{1}{2}})$	*Limit*	...	73901		

May 1955.

Pb I Observed Terms*

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,4f^{14}\,5s^2\,5p^6\,5d^{10}+$	Observed Terms			
$6s^2\,6p^2$	$6p^2\ ^1S$	$6p^2\ ^3P$	$6p^2\ ^1D$	
	$ns\ (n\geq 7)$		$np\ (n\geq 7)$	
$6s^2\,6p(^2P^\circ)nx$	7 to $17s\ ^3P^\circ$ $7s\ ^1P^\circ$		7 to $10p\ ^3P$	7 to $9p\ ^3D$
	$nd\ (n\geq 6)$		$nf\ (n\geq 5)$	
$6s^2\,6p(^2P^\circ)nx$	6 to $8d\ ^3P^\circ$	6 to $20d\ ^3D^\circ$	6 to $12d\ ^3F^\circ$	5 to $10f\ ^3F$? 6 to $11f\ ^1F$?

*For predicted terms in the spectra of the Pb I isoelectronic sequence, see Vol. III, Introduction.

Pb II

(Tl I sequence; 81 electrons) $Z=82$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,4f^{14}\,5s^2\,5p^6\,5d^{10}\,6s^2\,6p\ {}^2P^{\circ}_{0\frac{1}{2}}$

$6p\ {}^2P^{\circ}_{0\frac{1}{2}}$ *121243* K I. P. 15.028 volts

The analysis is from Earls and Sawyer, who have revised and extended the earlier work by Fr. Gieseler and others. "The spectrum was photographed from 800 A to 10000 A." Fourteen lines, observed also by Arvidsson in the vacuum region, were utilized in the analysis and in the determination of the limit. There are approximately 250 classified lines in the interval 840.25 A to 9864.2 A.

The limits of the $^2F^{\circ}$ and ^2G series have been used to derive the ionization limit, which has an estimated error of 2 or 3 K. The ^2S and ^2D series show irregularities due to perturbations caused by "intermingling levels from the $6s\,6p^2$ configuration."

Green and Loring have observed the Zeeman effect of Pb II and published 15 g-values based on the analysis by Fr. Gieseler. Earls and Sawyer have used these Zeeman observations to derive g-values for 10 "even" levels, by assuming the appropriate unperturbed theoretical g-values for the respective "odd" levels and applying the formulas of Shenstone and Blair for unresolved patterns. The writer has derived the observed g-values tabulated for both "even" and "odd" levels from the same observations and formulas, without assuming theoretical g-values, but by adopting the revisions in analysis suggested by Earls and Sawyer.

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Pb II

Config.	Desig.	J	Level	Interval	Obs. g
$6s^2(^1S)6p$	$6p\ ^2P^{\circ}$	0½	*0*	14081	
		1½	*14081*		1. 33
$6s\,6p^2$	$6p^2\ ^4P$	0½	57911	8213	
		1½	66124	7781	1. 64
		2½	73905		1. 52
$6s^2(^1S)7s$	$7s\ ^2S$	0½	59448		2. 01
$6s^2(^1S)6d$	$6d\ ^2D$	2½	68964	−776	1. 29
		1½	69740		0. 81
$6s^2(^1S)7p$	$7p\ ^2P^{\circ}$	0½	*74459*	2813	0. 60
		1½	*77272*		1. 33
$6s\,6p^2$	$6p^2\ ^2D$	1½	83083	5889	
		2½	88972		
$6s\,6p^2$	$6p^2\ ^2P$	0½	88248	16421	
		1½	104669		
$6s^2(^1S)8s$	$8s\ ^2S$	0½	89180		
$6s^2(^1S)5f$	$5f\ ^2F^{\circ}$	3½	*92514*	−15	1. 11
		2½	*92529*		0. 84
$6s^2(^1S)7d$	$7d\ ^2D$	1½	94284	1020	0. 80
		2½	95304		1. 18
$6s^2(^1S)8p$	$8p\ ^2P^{\circ}$	0½	*95077*	1161	
		1½	*96238*		
$6s^2(^1S)9s$	$9s\ ^2S$	0½	101346		1. 96

Pb II

Config.	Desig.	J	Level	Interval	Obs. g
$6s^2(^1S)6f$	$6f\ ^2F^{\circ}$	3½	*102868*	−13	1. 14
		2½	*102881*		0. 83
$6s^2(^1S)8d$	$8d\ ^2D$	1½	103394	796	0. 76?
		2½	104190		1. 21
$6s^2(^1S)5g$	$5g\ ^2G$	3½, 4½	103559		
$6s\,6p^2$	$6p^2\ ^2S$	0½	104297		
$6s^2(^1S)9p$	$9p\ ^2P^{\circ}$	0½	*104422*	598	
		1½	*105020*		
$6s^2(^1S)10s$	$10s\ ^2S$	0½	107930		
$6s^2(^1S)7f$	$7f\ ^2F^{\circ}$	3½	*108529*	−9	
		2½	*108538*		
$6s^2(^1S)6g$	$6g\ ^2G$	3½, 4½	108968		
$6s^2(^1S)9d$	$9d\ ^2D$	1½	109257	79	
		2½	109336		
$6s^2(^1S)10p$	$10p\ ^2P^{\circ}$	0½	*109500*	351	
		1½	*109851*		
$6s^2(^1S)11s$	$11s\ ^2S$	0½	111574		
$6s^2(^1S)8f$	$8f\ ^2F^{\circ}$	3½	*111940*	−6	
		2½	*111946*		
$6s^2(^1S)7g$	$7g\ ^2G$	3½, 4½	112230		

Pb II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$6s^2(^1S)10d$	$10d\ ^2D$	1½ 2½	112409 112467	58	
$6s^2(^1S)11p$	$11p\ ^2P^\circ$	0½ 1½	*112578* *112800*	222	
$6s^2(^1S)12s$	$12s\ ^2S$	0½	113912		
$6s^2(^1S)9f$	$9f\ ^2F^\circ$	3½ 2½	*114145* *114150*	−5	
$6s^2(^1S)8g$	$8g\ ^2G$	3½, 4½	114346		
$6s^2(^1S)11d$	$11d\ ^2D$	1½ 2½	114466 114507	41	
$6s^2(^1S)12p$	$12p\ ^2P^\circ$	0½ 1½	*114585* *114735*	150	
$6s^2(^1S)13s$	$13s\ ^2S$	0½	115496		
$6s^2(^1S)10f$	$10f\ ^2F^\circ$	3½ 2½	*115653* *115657*	−4	
$6s^2(^1S)9g$	$9g\ ^2G$	3½, 4½	115797		
$6s^2(^1S)12d$	$12d\ ^2D$	1½ 2½	115885 115912	27	
$6s^2(^1S)13p$	$13p\ ^2P^\circ$	0½ 1½	*115967* *116072*	105	
$6s^2(^1S)14s$	$14s\ ^2S$	0½	116615		
$6s^2(^1S)11f$	$11f\ ^2F^\circ$	3½ 2½	*116728* *116730*	−2	
$6s^2(^1S)10g$	$10g\ ^2G$	3½, 4½	116833		
$6s^2(^1S)13d$	$13d\ ^2D$	1½ 2½	116899 116920	21	
$6s^2(^1S)14p$	$14p\ ^2P^\circ$	0½ 1½	*116958*		

Pb II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$6s^2(^1S)12f$	$12f\ ^2F^\circ$	3½ 2½	*117520* *117522*	−2	
$6s^2(^1S)11g$	$11g\ ^2G$	3½, 4½	117600		
$6s^2(^1S)14d$	$14d\ ^2D$	1½ 2½	117650 117666	16	
$6s^2(^1S)13f$	$13f\ ^2F^\circ$	3½ 2½	*118181* *118182*	−1	
$6s^2(^1S)12g$	$12g\ ^2G$	3½, 4½	118183		
$6s^2(^1S)15d$	$15d\ ^2D$	1½ 2½	118223 118235	12	
$6s^2(^1S)14f$	$14f\ ^2F^\circ$	3½ 2½	*118588*		
$6s^2(^1S)13g$	$13g\ ^2G$	3½, 4½	118637		
$6s^2(^1S)16d$	$16d\ ^2D$	1½ 2½	118668 118679	11	
$6s^2(^1S)14g$	$14g\ ^2G$	3½, 4½	118996		
$6s^2(^1S)17d$	$17d\ ^2D$	1½ 2½	119022 119031	9	
$6s^2(^1S)15g$	$15g\ ^2G$	3½, 4½	119286		
$6s^2(^1S)18d$	$18d\ ^2D$	1½ 2½	119315		
$6s^2(^1S)19d$	$19d\ ^2D$	1½ 2½	119548		
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Pb III ($^1S_0$)	*Limit*	--------	*121243*		

January 1955.

Pb II Observed Terms*

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}$ $4s^2\ 4p^6\ 4d^{10}\ 5s^2\ 5p^6\ 5d^{10}+$	Observed Terms				
$6s^2(^1S)6p$	$6p\ ^2P^\circ$				
$6s\ 6p^2$	$6p^2\ ^2S$ { $6p^2\ ^4P$ $6p^2\ ^2P$ $6p^2\ ^2D$				
	$ns\ (n \geq 7)$	$np\ (n \geq 7)$	$nd\ (n \geq 6)$	$nf\ (n \geq 5)$	$ng\ (n \geq 5)$
$6s^2(^1S)nx$	7 to $14s\ ^2S$	7 to $14p\ ^2P^\circ$	6 to $19d\ ^2D$	5 to $14f\ ^2F^\circ$	5 to $15g\ ^2G$

*For predicted terms in the spectra of the Tl I isoelectronic sequence, see Vol. III, Introduction.

Pb III

(Hg I sequence; 80 electrons) $Z=82$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,4f^{14}\,5s^2\,5p^6\,5d^{10}\,6s^2\;{}^1S_0$

$6s^2\;{}^1S_0$ 257592±5 K I. P. 31.93 volts

The configuration-interaction in the Pb III spectrum has been studied in great detail by Hume, Crawford, McLay, and Crooker. Wave functions of 52 levels have been determined in terms of the (LS) functions, and the configuration-perturbation parameters evaluated by fitting the calculated to the observed level values. Hume and Crawford give most of the details in their 1951 paper. The data in the table are, however, from an unpublished manuscript furnished by Crawford for inclusion here. The observed g-values are from Green and Loring.

The earlier papers by Stanley Smith, Crooker, and Rao and Narayan contain over 100 classified lines in the interval 995.75 A to 5857.96 A. About 400 lines are reported as classified, however.

The limit has been calculated from the $6s\,nh$ sequence. The authors comment that the fine structure of the H-terms has not been resolved, but lines of G-H° multiplets are diffuse, indicating small intervals for the H-terms.

Both hyperfine structure and isotope shift affect the values of the observed energy levels. When an isotope shift is given for a level in the 1951 paper, the adopted value is the mean of the value for Pb^{206} and Pb^{208}.

In the table the levels are listed in order of increasing values. No attempt has been made to group them into their respective terms, because in many cases more than one designation is involved for a given level. On account of perturbations, LS-coupling notation does not apply throughout. For a number of levels the dominant contributor as given by Hume and Crawford is entered in the "Desig." column. The writer has made tentative designation assignments for $6p''\;{}^3F^{\circ}_{3}$, $5f\;{}^{1,3}F^{\circ}_{3}$, $6p''\;{}^3D^{\circ}_{3}$, $5,6,7,8g\;{}^{1,3}G_4$, $6,7,8,9h\;{}^{1,3}H^{\circ}$, and $7s'\;{}^{1,3}P^{\circ}$. The authors give configurations for these levels, but have not calculated the wave functions.

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Pb III

Authors	Config.	Desig.	J	Level	Obs. g
1_0	$5d^{10}\,6s^2$	$6s^2\;{}^1S$	0	0	
1°_{0}	$5d^{10}\,6s(^2S)6p$	$6p\;{}^3P^{\circ}$	0	*60397*	
2°_{1}	$5d^{10}\,6s(^2S)6p$	$6p\;{}^3P^{\circ}$	1	*64391*	
3°_{2}	$5d^{10}\,6s(^2S)6p$	$6p\;{}^3P^{\circ}$	2	*78984.6*	
4°_{1}	$5d^{10}\,6s(^2S)6p$	$6p\;{}^1P^{\circ}$	1	*95340.1*	
2_0	$5d^{10}\,6p^2$	$6p^2\;{}^3P$	0	142551	
3_1	$5d^{10}\,6s(^2S)7s$	$7s\;{}^3S$	1	150063.7	1.98
4_2	$5d^{10}\,6s(^2S)6d$	$6d\;{}^1D$	2	151884.5	1.06
5_0	$5d^{10}\,6s(^2S)7s$	$7s\;{}^1S$	0	153783.4	
5°_{2}	$5d^9\,6s^2(^2D)6p$	$6p''\;{}^3P^{\circ}$	2	*154494.0*	
6_1	$5d^{10}\,6p^2$	$6p^2\;{}^3P$	1	155431.5	
7_1	$5d^{10}\,6s(^2S)6d$	$6d\;{}^3D$	1	157444.1	0.50

Pb III—Continued

Authors	Config.	Desig.		J	Level	Obs. g
8_2	$5d^{10}\,6s(^2S)6d$	$6d$	^3D	2	*157925.0*	1.15
9_3	$5d^{10}\,6s(^2S)6d$	$6d$	^3D	3	158956.8	1.33
10_2	$5d^{10}\,6p^2$	$6p^2$	^3P	2	164817.9	1.40
7^3_0	$5d^{10}\,6s(^2S)7p$	$7p$	$^3P^\circ$	0	*170917.3*	
8^3_1	$5d^{10}\,6s(^2S)7p$	$7p$	$^3P^\circ$	1	*171081.4*	1.38
9^3_4	$5d^9\,6s^2(^2D)6p$	$6p''$	$^3F^\circ$	4	*173329*	
10^3_2	$5d^9\,6s^2(^2D)6p$	$6p''$	$^3F^\circ$	2	*173986.3*	0.97
11^3_1	$5d^9\,6s^2(^2D)6p$	$6p''$	$^3P^\circ$	1	*174600.9*	1.14
12^3_2	$5d^{10}\,6s(^2S)7p$	$7p$	$^3P^\circ$	2	*176022.9*	1.34
13^1_1	$5d^{10}\,6s(^2S)7p$	$7p$	$^1P^\circ$	1	*177181.4*	1.15
14^1_2	$5d^9\,6s^2(^2D)6p$	$6p''$	$^1D^\circ$	2	*177906.5*	1.08
11_2	$5d^{10}\,6p^2$	$6p^2$	^1D	2	178432	
15^3_3	$5d^9\,6s^2(^2D)6p$	$6p''$	$^3F^\circ$	3	*178957.0*	
16^1_1	$5d^9\,6s^2(^2D)6p$	$6p''$	$^1P^\circ$	1	*184268.1*	0.96
12_0	$5d^{10}\,6p^2$	$6p^2$	^1S	0	188615	
17^3_3	$5d^{10}\,6s(^2S)5f$	$5f$	$^3F^\circ$	3	*189785.2*	1.09
18^3_2	$5d^{10}\,6s(^2S)5f$	$5f$	$^3F^\circ$	2	*190287.8*	0.67
19^3_4	$5d^{10}\,6s(^2S)5f$	$5f$	$^3F^\circ$	4	*190429.0*	1.25
20^1_3	$5d^{10}\,6s(^2S)5f$	$5f$	$^1F^\circ$	3	*190901.2*	1.00
21^3_0	$5d^9\,6s^2(^2D)6p$	$6p''$	$^3P^\circ$	0	*192880*	
22^3_3	$5d^9\,6s^2(^2D)6p$	$6p''$	$^3D^\circ$	3	*196846.7*	1.03
23^3_1	$5d^9\,6s^2(^2D)6p$	$6p''$	$^3D^\circ$	1	*197318.6*	
13_1	$5d^{10}\,6s(^2S)8s$	$8s$	^3S	1	197892.8	2.00
24^3_2	$5d^9\,6s^2(^2D)6p$	$6p''$	$^3D^\circ$	2	*199343.9*	
14_0	$5d^{10}\,6s(^2S)8s$	$8s$	^1S	0	199400.6	
15_1	$5d^{10}\,6s(^2S)7d$	$7d$	^3D	1	201398.7	0.50
16_2	$5d^{10}\,6s(^2S)7d$	$7d$	^3D	2	201597.3	1.16
17_3	$5d^{10}\,6s(^2S)7d$	$7d$	^3D	3	202046.8	1.33
18_2	$5d^{10}\,6s(^2S)7d$	$7d$	^1D	2	203301.6	0.98
25^3_0	$5d^{10}\,6s(^2S)8p$	$8p$	$^3P^\circ$	0	*206809*	
26^3_1	$5d^{10}\,6s(^2S)8p$	$8p$	$^3P^\circ$	1	*206979*	
27^3_2	$5d^{10}\,6s(^2S)8p$	$8p$	$^3P^\circ$	2	*208922*	
28^1_1	$5d^{10}\,6s(^2S)8p$	$8p$	$^1P^\circ$	1	*209318*	
29^3_2	$5d^{10}\,6s(^2S)6f$	$6f$	$^3F^\circ$	2	*214434*	
30^3_3	$5d^{10}\,6s(^2S)6f$	$6f$	$^3F^\circ$	3	*214477*	
31^3_4	$5d^{10}\,6s(^2S)6f$	$6f$	$^3F^\circ$	4	*214486*	
32^1_3	$5d^{10}\,6s(^2S)6f$	$6f$	$^1F^\circ$	3	*214846*	
19_4	$5d^{10}\,6s(^2S)5g$	$5g$	^3G	4	217633.4	1.01
20_3	$5d^{10}\,6s(^2S)5g$	$5g$	^3G	3	217635.3	0.8
21_5	$5d^{10}\,6s(^2S)5g$	$5g$	^3G	5	217659.1	
22_4	$5d^{10}\,6s(^2S)5g$	$5g$	^1G	4	217660.6	1.06
23_1	$5d^{10}\,6s(^2S)9s$	$9s$	^3S	1	219344	
24_0	$5d^{10}\,6s(^2S)9s$	$9s$	^1S	0	219910	
25_1	$5d^{10}\,6s(^2S)8d$	$8d$	^3D	1	221205	
26_2	$5d^{10}\,6s(^2S)8d$	$8d$	^3D	2	221307	
27_3	$5d^{10}\,6s(^2S)8d$	$8d$	^3D	3	221600	
28_2	$5d^{10}\,6s(^2S)8d$	$8d$	^1D	2	221938	
33^1_1	$5d^{10}\,6p(^2P^\circ_{1\frac{1}{2}})7s$	$7s'$	$^1P^\circ$	1	*224740*	0
34^3_0	$5d^{10}\,6p(^2P^\circ_{1\frac{1}{2}})7s$	$7s'$	$^3P^\circ$	0	*226618*	
35^3_1	$5d^{10}\,6p(^2P^\circ_{1\frac{1}{2}})6d$			1	*227584*	
36^3_2	$5d^{10}\,6p(^2P^\circ_{1\frac{1}{2}})6d$			2	*227807*	
37^3_3	$5d^{10}\,6p(^2P^\circ_{1\frac{1}{2}})6d$			3	*228039*	
29_4	$5d^{10}\,6s(^2S)6g$	$6g$	^3G	4	229845	
30_3	$5d^{10}\,6s(^2S)6g$	$6g$	^3G	3	229846	
31_5	$5d^{10}\,6s(^2S)6g$	$6g$	^3G	5	229870.5	
32_4	$5d^{10}\,6s(^2S)6g$	$6g$	^1G	4	229870	
38°	$5d^{10}\,6s(^2S)6h$	$6h$	$^{1,3}H^\circ$		*230085*	
33_1	$5d^{10}\,6s(^2S)10s$	$10s$	^3S	1	230954	
34_0	$5d^{10}\,6s(^2S)10s$	$10s$	^1S	0	231244	
35_1	$5d^{10}\,6s(^2S)9d$	$9d$	^3D	1	232019	
36_2	$5d^{10}\,6s(^2S)9d$	$9d$	^3D	2	232097	
37_3	$5d^{10}\,6s(^2S)9d$	$9d$	^3D	3	232274	
38_2	$5d^{10}\,6s(^2S)9d$	$9d$	^1D	2	232442	
39^3_2	$5d^{10}\,6p(^2P^\circ_{1\frac{1}{2}})6d$			2	*233820*	
39_4	$5d^{10}\,6s(^2S)7g$	$7g$	^3G	4	237212	
40_3	$5d^{10}\,6s(^2S)7g$	$7g$	^3G	3	237219	
42_4	$5d^{10}\,6s(^2S)7g$	$7g$	^1G	4	237239	
41_5	$5d^{10}\,6s(^2S)7g$	$7g$	^3G	5	237240	
40°	$5d^{10}\,6s(^2S)7h$	$7h$	$^{1,3}H^\circ$		*237589*	
$43_{3,4}$	$5d^{10}\,6s(^2S)8g$	$8g$	$^{1,3}G$		242005	
$44_{4,5}$	$5d^{10}\,6s(^2S)8g$	$8g$	$^{1,3}G$		242023	
41°	$5d^{10}\,6s(^2S)8h$	$8h$	$^{1,3}H^\circ$		*242130*	
42^3_1	$5d^{10}\,6p(^2P^\circ_{1\frac{1}{2}})7s$	$7s'$	$^3P^\circ$	1	*242321*	
43°	$5d^{10}\,6s(^2S)9h$	$9h$	$^{1,3}H^\circ$		*245378*	
44^3_2	$5d^{10}\,6p(^2P^\circ_{1\frac{1}{2}})7s$	$7s'$	$^3P^\circ$	2	*246144*	
	Pb IV($^2S_{0\frac{1}{2}}$)	*Limit*		---	*257592 ±5*	

November 1954.

Pb III Observed Terms*

Configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,4f^{14}\,5s^2\,5p^6+$	Observed Terms		
$5d^{10}\,6s^2$	$6s^2\ ^1S$		
$5d^{10}\,6p^2$	$6p^2\ ^3P$ $6p^2\ ^1S$ $6p^2\ ^1D$		
	$ns\ (n \geq 6)$	$np\ (n \geq 6)$	$nd\ (n \geq 6)$
$5d^{10}\,6s(^2S)nx$	7 to $10s\ ^3S$ 7 to $10s\ ^1S$	6 to $8p\ ^3P^\circ$ 6 to $8p\ ^1P^\circ$	6 to $9d\ ^3D$ 6 to $9d\ ^1D$
$5d^{10}\,6p(^2P^\circ)ns'$	$7s'\ ^3P^\circ$ $7s'\ ^1P^\circ$		
$5d^9\,6s^2(^2D)np''$		$6p''\ ^3P^\circ$ $6p''\ ^3D^\circ$ $6p''\ ^3F^\circ$ $6p''\ ^1P^\circ$ $6p''\ ^1D^\circ$	
	$nf\ (n \geq 5)$	$ng\ (n \geq 5)$	$nh\ (n \geq 6)$
$5d^{10}\,6s(^2S)nx$	5, $6f\ ^3F^\circ$ 5, $6f\ ^1F^\circ$	5 to $8g\ ^3G$ 5 to $8g\ ^1G$	6 to $9h\ ^3H^\circ$ 6 to $9h\ ^1H^\circ$

*For predicted terms of the Hg I isoelectronic sequence, see Vol. III, Introduction.

Pb IV

(Au I sequence; 79 electrons) $Z=82$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,4f^{14}\,5s^2\,5p^6\,5d^{10}\,6s\ ^2S_{1/2}$

$6s\ ^2S_{1/2}$ 341350 K I. P. 42.31 volts

Further study of the spectrum is needed. The early work on this spectrum was extended by Schoepfle in 1935 to include 98 classified lines between 459.04 A and 4496.21 A. Later, Crawford, McLay, and Crooker revised and extended the analysis and published 134 classified lines in the interval 432.880 A to 8749.7 A. The data in the table are from this later paper, and the numbers used by these authors to designate miscellaneous levels are retained in column one. The wavelengths of Arvidsson have been used in both papers for the region 432 A to 1438 A. The terms 6, 7, $8s\ ^2S$, $6p\ ^2P^\circ$, and $6,7d\ ^2D$, and 6 miscellaneous levels are common to both papers, but Schoepfle lists 19 levels not retained by Crawford and his associates.

By applying a Hicks formula to the $ns\ ^2S$ series ($ns=6$ to 8), Schoepfle derives the limit 340885, which gives an ionization potential of 42.25 volts. The limit quoted above "was obtained by assuming the sequence $nh\ ^2H^\circ$ to be hydrogenic".

This spectrum exhibits evidence of jj-coupling in the levels from the $5d^9\,6s(^{1,3}D)6p$ configuration. The notation for this coupling is discussed in the text for Au I. The authors assign the levels 1° through 4° to the configuration $5d^9_{2\frac{1}{2}}\,6s_{0\frac{1}{2}}\,6p_{0\frac{1}{2}}$. By comparison with isoelectronic spectra, Trees and the writer have made the additional jj-coupling configuration assignments given in the table for this group; they are extremely tentative. Schoepfle suggests that the levels labeled in the table 16° and 22°, may be $7p\ ^2P^\circ$, and that 24° may be $5f\ ^2F^\circ$. The observed g-values are consistent with this $7p\ ^2P^\circ$ assignment, but the overlapping of configurations makes a definitive choice difficult.

Pb IV—Continued

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Pb IV

Authors	Config.	Desig.	J	Level	Interval	Obs. g
	$5d^{10}(^1S)6s$	$6s\ ^2S$	0½	0		
	$5d^{10}(^1S)6p$	$6p\ ^2P^\circ$	0½ 1½	*76158* *97219*	21061	
1 2	$5d^9\,6s^2$	$6s^2\ ^2D$	2½ 1½	101252 122568	−21316	
1°	$5d^9_{2\frac{1}{2}}\,6s_{0\frac{1}{2}}\,6p_{0\frac{1}{2}}$		2½	*166369*		
2°	″		3½	*172667*		
3°	″		2½	*173248*		
4°	″		1½	*175388*		
	$5d^{10}(^1S)6d$	$6d\ ^2D$	1½ 2½	184558. 8 186816. 8	2258. 0	0. 78 1. 17
	$5d^{10}(^1S)7s$	$7s\ ^2S$	0½	185103. 0		1. 92
5°	$5d^9_{2\frac{1}{2}}\,6s_{0\frac{1}{2}}\,6p_{1\frac{1}{2}}$		1½	*188759*		
7°	″		2½	*193776*		
8°	″		3½	*193855*		
9°	″		1½	*193954*		
10°	″		0½	*194147*		
11°	″		2½	*197024*		
12°	$5d^9_{1\frac{1}{2}}\,6s_{0\frac{1}{2}}\,6p_{0\frac{1}{2}}$		1½	*200021*		
13°	″		0½	*201460*		
14°	$5d^9_{2\frac{1}{2}}\,6s_{0\frac{1}{2}}\,6p_{1\frac{1}{2}}$		3½	*208524. 0*		
15°	$5d^9_{1\frac{1}{2}}\,6s_{0\frac{1}{2}}\,6p_{0\frac{1}{2}}$		1½	*209051. 1*		
16°	$5d^9_{1\frac{1}{2}}\,6s_{0\frac{1}{2}}\,6p_{1\frac{1}{2}}$?		0½	*209788. 4*		0. 68
17°	$5d^9_{1\frac{1}{2}}\,6s_{0\frac{1}{2}}\,6p_{1\frac{1}{2}}$		0½	*210369. 7*		
18°	$5d^9_{1\frac{1}{2}}\,6s_{0\frac{1}{2}}\,6p_{0\frac{1}{2}}$		2½	*213519. 2*		
19°	$5d^9_{1\frac{1}{2}}\,6s_{0\frac{1}{2}}\,6p_{1\frac{1}{2}}$		1½	*214842. 1*		
20°			3½	*214891. 8*		
21°	$5d^9_{1\frac{1}{2}}\,6s_{0\frac{1}{2}}\,6p_{1\frac{1}{2}}$		2½	*217216*		
22°	″ ?		1½	*217851. 9*		1. 29
23°	″		2½	*219461. 0*		
24°	″		3½	*221716. 1*		
25°			0½	*231013*		
26°			2½	*232638*		
27°			1½	*235565*		
	$5d^{10}(^1S)8s$	$8s\ ^2S$	0½	249634. 5		
	$5d^{10}(^1S)7d$	$7d\ ^2D$	1½ 2½	250401. 6 251419. 5	1017. 9	
	$5d^{10}(^1S)5g$	$5g\ ^2G$	4½ 3½	270496 270498	−2	
	$5d^{10}(^1S)6h$	$6h\ ^2H^\circ$	4½, 5½	*292543*		
	$5d^{10}(^1S)7h$	$7h\ ^2H^\circ$	4½, 5½	*305516*		
	$5d^{10}(^1S)8h$	$8h\ ^2H^\circ$	4½, 5½	*313939*		
	Pb V ($^1S_0$)	*Limit*	-------	341350		

September 1954.

Pb V

(Pt I sequence; 78 electrons) $Z=82$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^{10}\ {}^1S_0$

$5d^{10}\ {}^1S_0$ 555000 K I. P. 68.8 volts

The analysis is from Schoepfle, who has extended the early work of Mack and the subsequent investigation by Mack and Fromer. The levels have been based on the observations by Arvidsson, who separated the lines belonging to the spectra of different stages of ionization. About 200 lines have been classified in the interval 284.329 A to 1401.56 A.

The spectra of the Pt I isoelectronic sequence are of special theoretical interest because they approach *jj*-coupling rather than *LS*- or *Jl*-coupling. This appears more conspicuously in the spectra of higher ionization, especially among the levels from the $5d^9(^2D)6p$ configuration. A detailed study of "The Four Vector Problem and Its Application to Energies and Intensities in Platinum-like Spectra" has been made by Goble. In *LS*-coupling this configuration gives rise to the terms $^{1,3}(P^\circ D^\circ F^\circ)$. In *jj*-coupling the same number of energy levels and the same resultant *J*-values occur, but each level is defined by two *j*-values, one for the *d*-electron (1½ or 2½), and one for the *p*-electron, (0½ or 1½).

In the table the writer has assigned *LS*-designations only in the case of the $^{1,3}D$ terms from the $5d^9(^2D)ns$ configuration, although the *jj*-coupling applies here, also. "Odd" levels are in italics throughout. The *j*-values for the *d*- and *p*-electrons as required for *jj*-coupling, are indicated in the configuration column, the former being the same as the *J*-values of the limit term ^2D. A table giving the transformation from *jj*- to *LS*-coupling may be found in the book by Condon and Shortley, p. 294.

Schoepfle uses as the ionization limit the value 562600 derived from a Ritz formula, from which he apparently derived the absolute value of the level $5d^9(^2D_{2\frac{1}{2}})6p_{1\frac{1}{2}}$, $J=3$. The corresponding ionization potential is 69.7 volts. Mack and Fromer quote an ionization potential derived from a Moseley diagram for the sequence. This estimate is based on a two-member series, $5d^9(^2D_{2\frac{1}{2}})ns(n=6,7)$, $J=3$, represented by a Rydberg formula to which the same Ritz correction is applied as for the spectrum of the same stage of ionization in the Au I sequence. Their limit is quoted here.

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Pb v

Config.	Desig.	J	Level	Interval
$5d^{10}$	$5d^{10}\ ^1S$	0	0	
$5d^9(^2D_{2\frac{1}{2}})6s$	$6s\ ^3D$	3	110768	−3937
		2	114705	−18006
$5d^9(^2D_{1\frac{1}{2}})6s$		1	132711	
$5d^9(^2D_{1\frac{1}{2}})6s$	$6s\ ^1D$	2	135997	
		2	141988	
$5d^9(^2D_{2\frac{1}{2}})6p_{\frac{1}{2}}$		2	*194808*	
$5d^9(^2D_{2\frac{1}{2}})6p_{\frac{1}{2}}$		3	*197131*	
		3	*199048*	
		3	*210514*	
		2	*211487*	
		3	*212872*	
		2	*213131*	
		2	*215804*	
$5d^9(^2D_{1\frac{1}{2}})6p_{\frac{1}{2}}$		2	*217069*	
		3	*218043*	
$5d^9(^2D_{1\frac{1}{2}})6p_{\frac{1}{2}}$		1	*219488*	
$5d^9(^2D_{2\frac{1}{2}})6p_{1\frac{1}{2}}$		4	*221069*	
$5d^9(^2D_{2\frac{1}{2}})6p_{1\frac{1}{2}}$		2	*223909*	
$5d^9(^2D_{2\frac{1}{2}})6p_{1\frac{1}{2}}$		3	*226511*	
		2	*227746*	
$5d^9(^2D_{2\frac{1}{2}})6p_{1\frac{1}{2}}$		1	*227835*	
		2	*232040*	
		2	*233830*	
$5d^9(^2D_{1\frac{1}{2}})6p_{1\frac{1}{2}}$		0	*237660*	
		1	*239418*	
$5d^9(^2D_{1\frac{1}{2}})6p_{1\frac{1}{2}}$		3	*244661*	
$5d^9(^2D_{1\frac{1}{2}})6p_{1\frac{1}{2}}$		1	*245277*	
$5d^9(^2D_{1\frac{1}{2}})6p_{1\frac{1}{2}}$		2	*247595*	
		2	*258588*	
		1	*260674*	
		3	283483	
		3	297112	
		2	299708	
		3	317397	
		2	326216	
		3	326888	
		4	327433	
		3	328234	
		3	329572	
		3	329935	
		2	331487	
		2	331749	
		2	332358	
		2	332501	
		1	335913	
$5d^9(^2D_{2\frac{1}{2}})7s$	$7s\ ^3D$	3	338440	−794
		2	339234	
		2	341595	
		2	*350605*	
		3	*358771*	
		2	*359928*	
$5d^9(^2D_{1\frac{1}{2}})7s$	$7s\ ^3D$	1	360496	
$5d^9(^2D_{1\frac{1}{2}})7s$	$7s\ ^1D$	2	361073	
$5d^9(^2D)7p$?		2	*397410*	
$5d^9(^2D)7p$?		3	*427096*	
$5d^9(^2D)7p$?		2	*427360*	
		2	450173	
$5d^9(^2D_{2\frac{1}{2}})8s$	$8s\ ^3D$	3	452624	−343
		2	452967	
		3	473642	
$5d^9(^2D_{1\frac{1}{2}})8s$	$8s\ ^3D$	1	476582	
$5d^9(^2D_{1\frac{1}{2}})8s$	$8s\ ^1D$	2	476894	
$5d^9(^2D_{2\frac{1}{2}})9s$	$9s\ ^3D$	3	546508	
		2		
$5d^9(^2D)8p$?		3	*554440*	
Pb vi$(^2D_{2\frac{1}{2}})$	*Limit*	-------	555000	
$5d^9(^2D)8p$?		3	*571267*	
$5d^9(^2D)8p$?		2	*575919*	
$5d^9(^2D)8p$?		3	*577526*	
$5d^9(^2D)8p$?		2	*604560*	

August 1954.

BISMUTH

Bi I

83 electrons $Z=83$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,4f^{14}\,5s^2\,5p^6\,5d^{10}\,6s^2\,6p^3\;{}^4S^{\circ}_{1\frac{1}{2}}$

$6p^3\;{}^4S^{\circ}_{1\frac{1}{2}}$ *58790* K — I. P. 7.287 volts

Although the Bi I spectrum has been studied by a number of investigators, yet no complete homogeneous set of observations exists. The spectrum needs to be reobserved and accurately measured over the entire photographic range.

Series were recognized by Thorsen in 1926. They were extended by Clearman in 1952 from observations in the short-wave region; his revised values of the limits are quoted here. Mrozowski has studied the hyperfine structure in detail and also extended the analysis.

The present list of energy levels is based mostly upon the terms given by Mrozowski and Clearman with revisions by the writer. She has prepared a line list from unpublished measurements by Meggers and Murphy, by Humphreys and Paul (infrared), and from Clearman's paper. She has recalculated the level values from these wavelengths and made additional tentative assignments of configurations for many miscellaneous levels. A number of published levels are omitted here, pending further confirmation. Some new levels have been added on evidence furnished by the series assignments. In general, however, further confirmation of many J-values, configurations, and levels is needed.

There are approximately 180 classified lines between 1362.84 A and 22551.6 A.

Most of the levels are listed in increasing numerical order in the table, because of the departure from LS-coupling. Some LS-designations are, however, indicated on the evidence afforded by the observed g-values.

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Bi I

Config.	Desig.	J	Level	Interval	Obs. g
$6p^3$	$6p^3\ ^4S^\circ$	1½	*0.00*		
$6p^3$	$6p^3\ ^2D^\circ$	1½ 2½	*11418.03* *15437.66*	4018.63	1.225 1.20
$6p^3$	$6p^3\ ^2P^\circ$	0½ 1½	*21661.0* *33164.84*	11503.8	0.667
$6p^2(^3P_0)7s$	$7s\ ^4P$	0½	32588.17		2.088
$6p^2(^3P_0)7p$		0½?	*41125.18*		
$6p^2(^3P_0)7p$		1½	*42940.6*		
$6p^2(^3P_0)6d$	$6d\ ^2D$	1½	43912.67		0.79
$6p^2(^3P_0)6d$	$6d\ ^2D$	2½	44816.86		1.20
$6p^2(^3P_1)7s$	$7s\ ^4P$	1½	44865.08		1.676
$6p^2(^3P_1)7s$	$7s\ ^2P$?	0½	45915.57		1.30
$6p^2(^3P_0)8s$	$8s\ ^4P$	0½	47373.23		
$6p^2(^3P_2)7s$	$7s\ ^4P$	2½	48489.88		1.41
$6p^2(^3P_2)7s$	$7s\ ^2P$?	1½	49456.6		0.98
$6p^2(^3P_0)8p$		0½?	*49997.48?*		
$6p^2(^3P_0)7d$	$7d\ ^2D$	1½	51019.11		
$6p^2(^3P_0)7d$	$7d\ ^2D$	2½	51158.65		
$6p^2(^3P_0)9s$	$9s\ ^4P$	0½	52255.36		
$6p^2(^3P_0)9p$		0½?	*53471. ?*		
$6p^2(^3P_0)8d$	$8d\ ^2D$	2½	53878.6		
$6p^2(^3P_1)7p$		0½	*53893.74*		
$6p^2(^3P_0)8d$	$8d\ ^2D$	1½	53976.84		
$6p^2(^3P_0)10s$	$10s\ ^4P$	0½	54559.7		
$6p^2(^3P_1)7p$		1½	*54570.53*		
$6p^2(^3P_0)9d$	$9d\ ^2D$	1½	55424.3		
$6p^2(^3P_0)9d$	$9d\ ^2D$	2½	55478.0		
$6p^2(^3P_0)11s$	$11s\ ^4P$	0½	55822.2		
$6p^2(^3P_1)7p$		1½?	*56088.3*		
$6p^2(^3P_1)7p$		0½?	*56275.4*		
$6p^2(^3P_0)10d$	$10d\ ^2D$	1½	56320		
$6p^2(^3P_1)6d$		1½	56570.50		
$6p^2(^3P_0)12s$	$12s\ ^4P$	0½	56591?		
$6p^2(^3P_1)6d$		2½	57076		
$6p^2(^3P_1)6d$		0½	57607.0		
$6p^2(^3P_1)6d$		1½	57767.8		
$6p^2(^3P_1)6d$		2½	58273.64		
$6p^2(^3P_1)6d$		3½	58377.6		
Bi II$(^3P_0)$	*Limit*	------	*58790*		
$6p^2(^3P_1)8s$	$8s\ ^4P$	1½	60817		

Bi I

Config.	Desig.	J	Level	Interval	Obs. g
$6p^2(^3P_1)8s$	$8s\ ^2P$?	0½	61133?		
$6p^2(^3P_2)6d$		0½?	61495?		
$6p^2(^3P_2)6d$		1½	61812		
$6p^2(^3P_2)6d$		1½	62744		
$6p^2(^3P_1)8p$		0½?	*62870.9?*		
$6p^2(^3P_1)8p$		1½?	*63200.6*		
$6p^2(^3P_1)8p$		0½?	*63733.8?*		
$6p^2(^3P_2)8s$	$8s\ ^4P$	2½	63858		
$6p^2(^3P_2)8s$	$8s\ ^2P$?	1½	64023		
$6p^2(^3P_1)7d$?		2½	64122		
$6p^2(^3P_1)7d$		0½	64238		
$6p^2(^3P_1)7d$		1½	64275		
$6p^2(^3P_1)7d$		2½	64575?		
$6p^2(^3P_1)9s$	$9s\ ^4P$	1½	65483		
$6p^2(^3P_1)9s$	$9s\ ^2P$?	0½	65612		
$6p^2(^3P_1)9p$		0½?	*66524.9?*		
$6p^2(^3P_1)9p$		0½?	*66992.1?*		
$6p^2(^1D_2)7s$		1½?	67117		
$6p^2(^3P_1)8d$		0½	67216?		
$6p^2(^3P_1)8d$?		1½?	67328		
$6p^2(^3P_1)10s$?	$10s\ ^4P$?	1½	67832		
$6p^2(^3P_2)7d$		0½?	68049?		
$6p^2(^1D_2)7s$		2½?	68086		
$6p^2(^3P_1)10p$		0½?	*68365.5?*		
$6p^2(^3P_1)9d$		0½	68764		
$6p^2(^3P_2)9s$	$9s\ ^4P$	2½	68967?		
$6p^2(^3P_2)9s$	$9s\ ^2P$	1½	69120?		
$6p^2(^3P_2)8d$		0½?	70931?		
$6p^2(^3P_2)10s$	$10s\ ^2P$	1½	71499?		
Bi II$(^3P_1)$	*Limit*	------	72112		
$6p^2(^3P_2)9d$		0½?	72463?		
$6p^2(^3P_2)10d$		0½?	73376?		
Bi II$(^3P_2)$	*Limit*	------	75815		
Bi II$(^1D_2)$	*Limit*		92720		

October 1956.

Bi II

(Pb I sequence; 82 electrons) $Z=83$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,4f^{14}\,5s^2\,5p^6\,5d^{10}\,6s^2\,6p^2\ {}^3P_0$

$6p^2\ {}^3P_0$ 134600 K I. P. 16.68 volts

The energy levels and limit are from Crawford and McLay, the authors who assigned the arbitrary numbers listed in the first column of the table. In 1947, Murakawa and Suwa revised and extended the *jj*-coupling assignments of these authors and also suggested *LS*-designations for nearly all of the levels. Their results are quoted in the second and third columns of the table.

The level at 112645 K is from this paper, and the levels labeled 25_3 and 21_4 are found only in the earlier one. The level at 117004 K is listed as both "even" ($6p_{\frac{1}{2}}\,6f_{2\frac{1}{2}}\ {}^3F_3$) (1947) and "odd" ($6p_{\frac{1}{2}}\,5g$) (1934). On the basis of the combinations in the 1934 paper, the latter configuration has been adopted in the table. This level has been "assumed hydrogenic" for the calculation of the limit.

There are approximately 190 lines in the interval 937.95 A to 8863 A, including some "forbidden" transitions. The hyperfine structure exhibited by a number of the lines is discussed in detail by Fisher and Goudsmit and others. The over-all separation is wide for a number of the energy levels.

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Bi II

Authors	Config.	Desig.	J	Level	Interval
1_0	$6p_{\frac{1}{2}}\,6p_{\frac{1}{2}}$	$6p^2\ {}^3P$	0	0	
2_1	$6p_{\frac{1}{2}}\,6p_{1\frac{1}{2}}$		1	13324	13324
3_2	$6p_{\frac{1}{2}}\,6p_{1\frac{1}{2}}$		2	17030	3706
4_2	$6p_{1\frac{1}{2}}\,6p_{1\frac{1}{2}}$	$6p^2\ {}^1D$	2	33936	
5_0	$6p_{1\frac{1}{2}}\,6p_{1\frac{1}{2}}$	$6p^2\ {}^1S$	0	44173	
1°_{0}	$6p_{\frac{1}{2}}\,7s$	${}^3P^{\circ}$	0	*69133*	
2°_{1}	$6p_{\frac{1}{2}}\,7s$	${}^3P^{\circ}$	1	*69598*	
4°_{2}	$6s\,6p^3$	$6p^3\ {}^5S^{\circ}$	2	*76147*	
5°_{2}	$6p_{\frac{1}{2}}\,6d_{1\frac{1}{2}}$	${}^3D^{\circ}$	2	*79089*	
6°_{1}	$6p_{\frac{1}{2}}\,6d_{1\frac{1}{2}}$	${}^3D^{\circ}$	1	*80575*	
7°_{2}	$6p_{\frac{1}{2}}\,6d_{2\frac{1}{2}}$	${}^3F^{\circ}$	2	*82047*	
8°_{3}	$6p_{\frac{1}{2}}\,6d_{2\frac{1}{2}}$	${}^3F^{\circ}$	3	*82255*	
6_1	$6p_{\frac{1}{2}}\,7p_{\frac{1}{2}}$	${}^3D$	1	84281	
7_0	$6p_{\frac{1}{2}}\,7p_{\frac{1}{2}}$	${}^3P$	0	87078	
8_1	$6p_{\frac{1}{2}}\,7p_{1\frac{1}{2}}$	${}^1P$	1	88566	
9°_{2}	$6p_{1\frac{1}{2}}\,7s$	${}^3P^{\circ}$	2	*88769*	
9_2	$6p_{\frac{1}{2}}\,7p_{1\frac{1}{2}}$	${}^3D$	2	88789	
10°_{1}	$6p_{1\frac{1}{2}}\,7s$	${}^1P^{\circ}$	1	*89883*	
11°_{1}	$6s$	${}^3D^{\circ}$	1	*94440*	
12°_{2}	$6s\,6p^3$	${}^3D^{\circ}$	2	*94928*	
13°_{3}	$6s\,6p^3$	${}^3D^{\circ}$	3	*96057*	
14°_{2}	$6p_{1\frac{1}{2}}\,6d$	${}^3P^{\circ}$	2	*99011*	
15°_{1}	$6p_{1\frac{1}{2}}\,6d$	${}^3P^{\circ}$	1	*100492*	
16°_{1}	$6p_{\frac{1}{2}}\,8s$	${}^3P^{\circ}$	1	*101341*	
17_0	$6p_{1\frac{1}{2}}\,6d$	${}^3P^{\circ}$	0	*101464*	
18°_{2}	$6p_{1\frac{1}{2}}\,6d$	${}^1D^{\circ}$	2	*102330*	
19°_{3}	$6p_{1\frac{1}{2}}\,6d$	${}^3D^{\circ}$	3	*103003*	
10_2	$6p_{\frac{1}{2}}\,5f_{2\frac{1}{2}}$	${}^3F$	2	105083	
11_2	$6p_{1\frac{1}{2}}\,7p_{\frac{1}{2}}$	${}^3P$	2	105269	
12_3	$6p_{\frac{1}{2}}\,5f$	${}^3G$	3	105287	
13_3	$6p_{\frac{1}{2}}\,5f$	${}^3F$	3	105449	
20°_{2}	$6p_{\frac{1}{2}}\,7d$	${}^3D^{\circ}$	2	*105526*	
14_4	$6p_{\frac{1}{2}}\,5f_{2\frac{1}{2}}$	${}^3F$	4	105726	

Bi II—Continued

Authors	Config.	Desig.	J	Level	Interval
15_1	$6p_{0½}\ 8p_{0½}$	^3D	1	106447	
21°_{1}	$6p_{0½}\ 7d$	$^3D^{\circ}$	1	*106611*	
21_0	$6p_{0½}\ 8p_{0½}$	^3P	0	107976	
22°_{3}	$6p_{0½}\ 7d_{2½}$	$^1F^{\circ}$	3	*108007*	
23°_{1}	$6p_{1½}\ 6d$	$^1P^{\circ}$	1	*108186*	
16_3	$6p_{1½}\ 7p_{1½}$	^3D	3	108278	
17_1	$6p_{0½}\ 8p_{1½}$	^1P	1	108404	
22_2	$6p_{0½}\ 8p_{1½}$	^3D	2	108886	
18_1	$6p_{1½}\ 7p_{1½}$	^3S	1	109104	
24°_{2}	$6p_{0½}\ 7d$	$^3F^{\circ}$	2	*109157*	

Bi II—Continued

Authors	Config.	Desig.	J	Level	Interval
19_2	$6p_{1½}\ 7p_{1½}$	^1D	2	109904	
	$6p_{1½}\ 7p_{1½}$	^1S	0	112645	
23_3	$6p_{0½}\ 6f$	^3G	3	115933	
24_4	$6p_{0½}\ 6f_{3½}$	^3F	4	115990	
25_3	$6p_{0½}\ 6f$	^3F	3	116089	
26_2	$6p_{0½}\ 6f_{2½}$	^3F	2	116212	
25°	$6p_{0½}\ 5g_{3½}$		3	*117004*	
	Bi III ($^2P^{\circ}_{0½}$)	*Limit*	------	134600	

January 1955.

Bi III

(Tl I sequence; 81 electrons) $Z=83$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^{10}\ 6s^2\ 6p\ ^2P^{\circ}_{0½}$

$6p\ ^2P^{\circ}_{0½}$ ***206180*** K I. P. 25.56 volts

The analysis is from Crawford and McLay, who have revised and extended their earlier work and that of Lang. There are 106 classified lines between 590.73 A and 8934 A. Arvidsson's measurements have been used in the short-wave region, 590 A to 1486 A, to supplement those of the authors.

The limit is based on the assumption that the term $7h\ ^2H^{\circ}$ is hydrogenic.

By analogy with Pb II, the writer has tentatively assigned *LS*-designations to the terms of the $6s\ 6p^2$ configuration. The authors adopt the following numerical labels and *jj*-coupling nomenclature for these levels:

Desig.	Config.	Desig.	Config.
$4_{½}$	$6s\ 6p_{½}\ 6p_{½}$	$6_{1½}$	$6s\ 6p_{½}\ 6p_{1½}$
$1_{1½}$	$6s\ 6p_{½}\ 6p_{1½}$	$3_{2½}$	$6s\ 6p_{1½}\ 6p_{1½}$
$2_{2½}$	$6s\ 6p_{½}\ 6p_{1½}$	$7_{1½}$	$6s\ 6p_{1½}\ 6p_{1½}$
$5_{½}$	$6s\ 6p_{½}\ 6p_{1½}$	$8_{½}$	$6s\ 6p_{1½}\ 6p_{1½}$

Fisher and Goudsmit report wide hyperfine structure intervals for these levels.

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Bi III

Authors	Config.	Desig.	J	Level	Interval
	$6s^2(^1S)6p$	$6p\ ^2P°$	$0\frac{1}{2}$ $1\frac{1}{2}$	*0* *20788*	20788
$4_{\frac{1}{2}}$ $1_{1\frac{1}{2}}$ $2_{2\frac{1}{2}}$	$6s\ 6p^2$	$6p^2\ ^4P$	$0\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$	70254 83038 89236	12784 6198
	$6s^2(^1S)7s$	$7s\ ^2S$	$0\frac{1}{2}$	95075	
	$6s^2(^1S)6d$	$6d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	96154 102446	6292
$5_{\frac{1}{2}}$ $7_{1\frac{1}{2}}$	$6s\ 6p^2$	$6p^2\ ^2P$	$0\frac{1}{2}$ $1\frac{1}{2}$	108052 130966	22914
$6_{1\frac{1}{2}}$ $3_{2\frac{1}{2}}$	$6s\ 6p^2$	$6p^2\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	108586 116414	7828
	$6s^2(^1S)7p$	$7p\ ^2P°$	$0\frac{1}{2}$ $1\frac{1}{2}$	*116993* *122128*	5135
$8_{\frac{1}{2}}$	$6s\ 6p^2$	$6p^2\ ^2S$	$0\frac{1}{2}$	130986?	
	$6s^2(^1S)5f$	$5f\ ^2F°$	$3\frac{1}{2}$ $2\frac{1}{2}$	*137455* *137555*	−100
	$6s^2(^1S)8s$	$8s\ ^2S$	$0\frac{1}{2}$	145227	
	$6s^2(^1S)7d$	$7d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	149086 149796	710

Bi III

Authors	Config.	Desig.	J	Level	Interval
	$6s^2(^1S)8p$	$8p\ ^2P°$	$0\frac{1}{2}$ $1\frac{1}{2}$	*154198* *156421*	2223
	$6s^2(^1S)6f$	$6f\ ^2F°$	$3\frac{1}{2}$ $2\frac{1}{2}$	*162186* *162242*	−56
	$6s^2(^1S)5g$	$5g\ ^2G$	$4\frac{1}{2}$ $3\frac{1}{2}$	166234 166237	−3
	$6s^2(^1S)9s$	$9s\ ^2S$	$0\frac{1}{2}$	167289	
	$6s^2(^1S)8d$	$8d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	169292 169657	365
	$6s^2(^1S)6g$	$6g\ ^2G$	$4\frac{1}{2}$ $3\frac{1}{2}$	178467 178470	−3
	$6s^2(^1S)6h$	$6h\ ^2H°$	$4\frac{1}{2}, 5\frac{1}{2}$	*178719*	
	$6s^2(^1S)7g$	$7g\ ^2G$	$4\frac{1}{2}$ $3\frac{1}{2}$	185850 185853	−3
	$6s^2(^1S)7h$	$7h\ ^2H°$	$4\frac{1}{2}, 5\frac{1}{2}$	*186024*	
	$6s^2(^1S)8g$	$8g\ ^2G$	$4\frac{1}{2}$ $3\frac{1}{2}$	190642 190644	−2
	Bi IV ($^1S_0$)	*Limit*	-------	*206180*	

January 1955.

Bi IV

(Hg I sequence; 80 electrons) $Z=83$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^{10}\ 6s^2\ ^1S_0$

$6s^2\ ^1S_0$ **365500 K** I. P. 45.3 volts

The analysis is incomplete, and is complicated because the spectrum exhibits both hyperfine structure and configuration-interaction. The early work by Arvidsson and by Stanley Smith has been extended by McLay and Crawford to include 139 classified lines in the range from 420.7 A to 5347 A. The energy levels in the table are quoted from the paper by these last two authors.

By analogy with Pb III the writer has added tentative *LS*-designations except for the terms $^{1,3}P°D°F°$ having the configuration $5d^9\ 6s^2(^2D)6p$, where the *jj*-coupling notation as given by the authors, is tabulated. For further use of this notation the 1933 reference should be consulted.

The limit has been "obtained by applying a Rydberg formula to $6s\ 6d\ 8_2$ and $6s\ 7d\ 17_2$".

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F. M. Kelly, R. Richmond, and M. F. Crawford, Phys. Rev. **80**, 295 (L) (1950). (hfs)

Bi IV

Authors	Config.	Desig.	J	Level
1_0	$5d^{10}\,6s^2$	$6s^2\ {}^1S$	0	0
1°_{0}	$5d^{10}\,6s(^2S)6p$	$6p\ {}^3P^{\circ}$	0	*70963*
2°_{1}	$5d^{10}\,6s(^2S)6p$	$6p\ {}^3P^{\circ}$	1	*75926*
3°_{2}	$5d^{10}\,6s(^2S)6p$	$6p\ {}^3P^{\circ}$	2	*96423*
4°_{1}	$5d^{10}\,6s(^2S)6p$	$6p\ {}^1P^{\circ}$	1	*114602*
2_0	$5d^{10}\,6p^2$	$6p^2\ {}^3P$	0	166552
3_2	$5d^{10}\,6s(^2S)6d$	$6d\ {}^1D$	2	184160
4_1	$5d^{10}\,6p^2$	$6p^2\ {}^3P$	1	185014
5_1	$5d^{10}\,6s(^2S)6d$	$6d\ {}^3D$	1	197151
6_1	$5d^{10}\,6s(^2S)7s$	$7s\ {}^3S$	1	197446
7_2	$5d^{10}\,6s(^2S)6d$	$6d\ {}^3D$	2	197829
8_3	$5d^{10}\,6s(^2S)6d$	$6d\ {}^3D$	3	199769
9_0	$5d^{10}\,6s(^2S)7s$	$7s\ {}^1S$	0	201581
10_2	$5d^{10}\,6p^2$	$6p^2\ {}^3P$	2	202434
11_2	$5d^{10}\,6p^2$	$6p^2\ {}^1D$	2	217823
7°_{2}	$5d^9_{1\frac{1}{2}}\,6s^2\,6p_{0\frac{1}{2}}$		2	*224292*
8° 9° 10° 11°	$5d^{10}\,6s(^2S)7p$	$7p\ {}^3P^{\circ}$	0, 1	*224584.6* *224600.2* *224607.0* *224611.9*
12°_{4}	$5d^9_{2\frac{1}{2}}\,6s^2\,6p_{1\frac{1}{2}}$		4	*225617*
13°_{1}	$5d^9_{1\frac{1}{2}}\,6s^2\,6p_{0\frac{1}{2}}$		1	*228127*
14°_{2}	$5d^9_{2\frac{1}{2}}\,6s^2\,6p_{1\frac{1}{2}}$		2	*230637*
15°_{1}	$5d^{10}\,6s(^2S)7p$	$7p\ {}^1P^{\circ}$	1	*231913*
16°_{2}	$5d^{10}\,6s(^2S)7p$	$7p\ {}^3P^{\circ}$	2	*232627*
17°_{3}	$5d^9\,6s^2\,6p_{1\frac{1}{2}}$?		3	*233233*
18°_{3}	$5d^{10}\,6s(^2S)5f$	$5f\ {}^3F^{\circ}$?	3	*233955*
19°_{2}	$5d^{10}\,6s(^2S)5f$	$5f\ {}^3F^{\circ}$	2	*235172*
20°_{4}	$5d^{10}\,6s(^2S)5f$	$5f\ {}^3F^{\circ}$	4	*235657*
21°_{3}	$5d^{10}\,6s(^2S)5f$	$5f\ {}^1F^{\circ}$?	3	*236518*
22°_{1}	$5d^9_{2\frac{1}{2}}\,6s^2\,6p_{1\frac{1}{2}}$		1	*237701*
13_1	$5d^{10}\,6s(^2S)8s$	$8s\ {}^3S$	1	266674
14_1	$5d^{10}\,6s(^2S)7d$	$7d\ {}^3D$	1	267576
15_2	$5d^{10}\,6s(^2S)7d$	$7d\ {}^3D$	2	267856
16_0	$5d^{10}\,6s(^2S)8s$	$8s\ {}^1S$	0	268191
17_3	$5d^{10}\,6s(^2S)7d$	$7d\ {}^3D$	3	268690
18_2	$5d^{10}\,6s(^2S)7d$	$7d\ {}^1D$	2	269758
	Bi v($^2S_{0\frac{1}{2}}$)	*Limit*	-------	365500

December 1954.

Bi V

(Au I sequence; 79 electrons) $Z=83$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^{10}\,4s^2\,4p^6\,4d^{10}\,4f^{14}\,5s^2\,5p^6\,5d^{10}\,6s\ {}^2S_{0\frac{1}{2}}$

$6s\ {}^2S_{0\frac{1}{2}}$ 451700 K I. P. 56.0 volts

In 1932 Arvidsson observed the spectrum in the extreme ultraviolet and classified three pairs of doublets. Later, Schoepfle extended the analysis with the aid of Arvidsson's measurements; his data are used in the table. There are 20 classified lines between 355.769 A and 1139.548 A.

Schoepfle states that the hyperfine separation of the ground term is 13 K. The combination of this term with $6p\ {}^2P^{\circ}_{0\frac{1}{2}}$ gives rise to two lines having respective wave numbers 87754.1 and 87767.8. Similarly, its combination with $6p\ {}^2P^{\circ}_{1\frac{1}{2}}$ gives the two components 115673.9 and 115686.8. Schoepfle adopts an average value for each of the $^2P^{\circ}$ levels, namely, *87760* and *115681*. In order to list the energy levels from the ground state zero, the writer has adopted the lower of the hyperfine-structure levels instead of the average of the two, and adjusted the values of other levels in the table based on combinations with $6p\ {}^2P^{\circ}$, accordingly. The small correction (-6 or -7 K) is perhaps negligible when it is considered that the observed Bi v lines lie in the far ultraviolet region. Arvidsson estimates that the measured wavelengths are probably accurate to about 0.03 A.

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Bi V

Config.	Desig.	J	Level	Interval
$5d^{10}(^1S_0)6s$	$6s\ ^2S$	$0\frac{1}{2}$	0	
$5d^{10}(^1S_0)6p$	$6p\ ^2P^\circ$	$0\frac{1}{2}$ $1\frac{1}{2}$	*87754* *115674*	27920
$5d^9\ 6s^2$	$6s^2\ ^2D$	$2\frac{1}{2}$ $1\frac{1}{2}$	103656 133772	−30116
	1	$1\frac{1}{2}$	223224	
$5d^{10}(^1S_0)6d$	$6d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	229289 232540	3251
$5d^{10}(^1S_0)7s$	$7s\ ^2S$	$0\frac{1}{2}$	233340	
$5d^{10}(^1S_0)7p$	$7p\ ^2P^\circ$	$0\frac{1}{2}$ $1\frac{1}{2}$	*270625* *281081*	10456
$5d^{10}(^1S_0)7d$	$7d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	317307 318629	1322
$5d^{10}(^1S_0)8s$	$8s\ ^2S$	$0\frac{1}{2}$	320430	
----------------	----------	-------	--------	
Bi VI$(^1S_0)$	*Limit*	-------	451700	

September 1954.

Bi VI

(Pt I sequence; 78 electrons) $Z=83$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^{10}\ ^1S_0$

$5d^{10}\ ^1S_0$ **712000 K** I. P. 88.3 volts

The analysis is from Schoepfle, who has extended the work of Mack and Fromer. Both investigations are based on the observations of Arvidsson, who reported the first regularities. There are in all, 91 classified lines in the interval 214.318 A to 1394.46 A, rejecting one dubious level above the ionization limit; and a level at 176585 which cannot be explained theoretically, as pointed out by Mack.

The spectra of the Pt I isoelectronic sequence are of special theoretical interest because they approach *jj*-coupling rather than *LS*- or *Jl*-coupling. This appears more conspicuously in the spectra of higher ionization, especially among the levels from the $5d^9(^2D)6p$ configuration. A detailed study of "The Four Vector Problem and Its Application to Energies and Intensities in Platinum-like Spectra" has been made by Goble. In *LS*-coupling this configuration gives rise to the terms $^{1,3}(P^\circ D^\circ F^\circ)$. In *jj*-coupling the same number of energy levels and the same resultant *J*-values occur, but each level is defined by two *j*-values, one for the *d*-electron ($1\frac{1}{2}$ or $2\frac{1}{2}$), and one for the *p*-electron ($0\frac{1}{2}$ or $1\frac{1}{2}$).

In the table, the writer has assigned *LS*-designations only in the case of the $^{1,3}D$ terms from the $5d^9(^2D)ns$ configuration, although the *jj*-coupling applies here also. The *j*-values for the *d*- and *p*-electrons as required for *jj*-coupling are indicated in the configuration column, the former being the same as the *J*-values of the limit term ^2D. A table giving the transformation from *jj*- to *LS*-coupling may be found in the book by Condon and Shortley, p. 294.

Schoepfle uses as the ionization limit the value 761800 derived by a Ritz formula from which he apparently determined the absolute value of the $5d^9(^2D_{2\frac{1}{2}})6p_{1\frac{1}{2}}$, $J=3$, level. The corresponding ionization potential is 94.4 volts.

Mack and Fromer quote an ionization potential derived from a Moseley diagram for the sequence. This estimate is based on a two-member series, $5d^9(^2D_{2\frac{1}{2}})ns$ ($n=6,7$), $J=3$ represented by a Rydberg formula to which the same Ritz correction is applied as for the spectrum of the same stage of ionization in the Au I sequence. Their limit is quoted here.

Bi VI—Continued

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J. E. Mack, letter (June 1956).

Bi VI

Config.	Desig.	J	Level	Interval
$5d^{10}$	$5d^{10}\ ^1S$	0	0	
$5d^9(^2D_{2\frac{1}{2}})6s$	$6s\ ^3D$	3 2	149495 153737	−4242 −21280
$5d^9(^2D_{1\frac{1}{2}})6s$		1	175017	
$5d^9(^2D_{1\frac{1}{2}})6s$	$6s\ ^1D$	2	178479	
		2	*237881*	
$5d^9(^2D_{2\frac{1}{2}})6p_{\frac{1}{2}}$		2	*244721*	
$5d^9(^2D_{2\frac{1}{2}})6p_{\frac{1}{2}}$		3	*247165*	
		2	*250191*	
$5d^9(^2D_{1\frac{1}{2}})6p_{\frac{1}{2}}$		2	*270603*	
$5d^9(^2D_{1\frac{1}{2}})6p_{\frac{1}{2}}$		1	*274158*	
$5d^9(^2D_{2\frac{1}{2}})6p_{1\frac{1}{2}}$		4	*277866*	
$5d^9(^2D_{2\frac{1}{2}})6p_{1\frac{1}{2}}$		2	*280930*	
$5d^9(^2D_{2\frac{1}{2}})6p_{1\frac{1}{2}}$		1	*284036*	
$5d^9(^2D_{2\frac{1}{2}})6p_{1\frac{1}{2}}$		3	*284058*	
$5d^9(^2D_{1\frac{1}{2}})6p_{1\frac{1}{2}}$		0	*298862*	
$5d^9(^2D_{1\frac{1}{2}})6p_{1\frac{1}{2}}$		3	*305272*	
$5d^9(^2D_{1\frac{1}{2}})6p_{1\frac{1}{2}}$		1	*305903*	
$5d^9(^2D_{1\frac{1}{2}})6p_{1\frac{1}{2}}$		2	*308613*	
		1	*315254*	
		2	*319259*	

Bi VI

Config.	Desig.	J	Level	Interval
		2	373679	
		2	401592	
$5d^9(^2D_{2\frac{1}{2}})7s$	$7s\ ^3D$	3 2	426587 427483	−896 −24797
$5d^9(^2D_{1\frac{1}{2}})7s$		1	452280	
$5d^9(^2D_{1\frac{1}{2}})7s$	$7s\ ^1D$	2	452914	
		1	539649	
$5d^9(^2D)7p$?		3	*556721*	
$5d^9(^2D)7p$?		3	*562057*	
		2	580252	
$5d^9(^2D_{2\frac{1}{2}})8s$	$8s\ ^3D$	3 2 1	606519 606754	−235
$5d^9(^2D_{1\frac{1}{2}})8s$	$8s\ ^1D$	2	631304	
		2	644278	
$5d^9(^2D_{2\frac{1}{2}})9s$	$9s\ ^3D$	3 2 1	711313	
Bi VII ($^2D_{2\frac{1}{2}}$)	*Limit*	-------	712000	
$5d^9(^2D)8p$?		3	*744960*	
$5d^9(^2D)8p$?		3	*749193*	

August 1956.

POLONIUM

Po I

84 electrons $Z=84$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^{10}\ 6s^2\ 6p^4\ {}^3P_2$

$6p^4\ {}^3P_2$ **67980 K** I. P. 8.43 volts

The analysis is from the paper by Charles, Hunt, Pish, and Timma, who have classified some 50 out of approximately 150 lines observed between 1919.4 A and 9374.80 A. They report that a study of the Zeeman effect is in progress. Their limit is from the $ns\ {}^{5,3}S^{\circ}$ series ($n=7, 8$), corrected by extrapolating the differences of the effective quantum numbers for Tl I, Pb I, and Bi I.

Mrozowski has classified 7 additional lines in the above list, and added the term $6p^4\ {}^1S_0$ and the 2 levels *53762* and *54471*. He attributes 3 of these lines to forbidden transitions of the multipole type, observed in emission, stating that they are "just the three strongest multipole lines to be expected."

Most of the levels and designations listed below have been reported independently by Vernyi, Zaidel, and Shvebel'blit, whose paper has just become available.

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Po I

Config.	Desig.	J	Level	Interval
$6p^4$	$6p^4\ {}^3P$	2 1 0	0 16831 7514	−16831 9317
$6p^4$	$6p^4\ {}^1D$	2	21679	
$6p^3(^4S^{\circ})7s$	$7s\ {}^5S^{\circ}$	2	*39081*	
$6p^3(^4S^{\circ})7s$	$7s\ {}^3S^{\circ}$	1	*40802*	
$6p^4$	$6p^4\ {}^1S$	0	42718	
	1°	2	*51712*	
	2°	3	*52099*	
	3°	1	*52532*	
	4°	1	*53027*	
		1	*53762*	
	5°	1	*54250*	
		1	*54471*	
	6°	2	*55465*	

Po I

Config.	Desig.	J	Level	Interval
$6p^3(^4S^{\circ})8s$	$8s\ {}^5S^{\circ}$?	2	*55923*	
$6p^3(^4S^{\circ})8s$	$8s\ {}^3S^{\circ}$?	1	*56268*	
	9°	1	*57077*	
$6p^3(^4S^{\circ})8p$?	10	1 or 2	59354	
	11°	2	*59469*	
$6p^3(^4S^{\circ})8p$?	12	1 or 2	59583	
	13°	1 or 2	*61818*	
$6p^3(^4S^{\circ})9p$?	14	1 or 2	62704	
$6p^3(^4S^{\circ})9p$?	15	1 or 2	62806	
	16°	1 or 2	*62884*	
	17°	1 or 2	*62959*	
$6p^3(^4S^{\circ})10p$?	18	1 or 2	64451	
Po II ($^4S_{1\frac{1}{2}}$)	*Limit*	-------	67980	

September 1956.

RADON

Rn I

86 electrons $Z=86$

Ground State $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^{10}\ 6s^2\ 6p^6\ {}^1S_0$

$6p^6\ {}^1S_0$ 86692.5 K I. P. 10.746 volts

The analysis is by Rasmussen, who has classified 172 lines in the interval 3316.14 A to 10161.45 A, in addition to the two resonance lines 1451.56 A and 1786.07 A. The series are well determined from a Ritz formula.

Edlén has noted that both the run of the quantum defects and the observed combinations indicate that the levels given by Rasmussen in the Paschen notation as $1s_3$ and $1s_2$, are, respectively, $3d_6$ and $3d_5$. This change has been made in the table, and Edlén's predicted positions of the $1s_3$ and $1s_2$ levels entered in brackets.

By analogy with Xe I, the writer has introduced *Jl*-coupling notation for Rn I in conformity with the designations adopted in these volumes for other spectra of the inert-gas type.

Rasmussen gives the following *LS*-designations for the different types of series:

Paschen	*LS*	Paschen	*LS*	Paschen	*LS*	Paschen	*LS*
s_5	$^3P_2$	p_8	$^3D_3$	d_4'	$^3F_4$	X	$^3D_1$
s_4	$^3P_1$	p_7	$^3D_1$	d_3	$^3P_2$	Y	$^3D_2$
s_3	$^3P_0$	p_6	$^3D_2$	d_4	$^3F_3$	Z	$^3F_4$
s_2	$^1P_1$	p_5	$^3P_0$	d_1''	$^3D_2$	U	$^3D_3$
p_{10}	$^3S_1$	d_6	$^3P_0$	d_1'	$^3D_3$	V	$^3F_3$
p_9	$^1D_2$	d_5	$^3P_1$	d_2	$^3D_1$	W	$^3F_2$

REFERENCES

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B. Edlén, Ark. Mat. Astr. Fys. (Stockholm) **29A**, No. 21, 4 (1943).

Rn I

Author	Config.	Desig.	*J*	Level
p_0	$6p^6$	$6p^6\ {}^1S$	0	0.0
$1s_5$	$6p^5(^2P^\circ_{1\frac{1}{2}})7s$	$7s\ [1\frac{1}{2}]^\circ$	2	*54620.35*
$1s_4$			1	*55989.03*
$1s_3$	$6p^5(^2P^\circ_{\frac{1}{2}})7s$	$7s'\ [0\frac{1}{2}]^\circ$	0	*[85976]*
$1s_2$			1	*[87053]*
$2p_{10}$	$6p^5(^2P^\circ_{1\frac{1}{2}})7p$		1	66244.97
$2p_9$	"		2	66707.53
$2p_8$			3	68039.48
$2p_7$	"	$7p\ [1\frac{1}{2}]$	1	68332.10
$2p_6$			2	68789.93
$2p_5$	"	$7p\ [0\frac{1}{2}]$	0	69743.98
$3d_6$	$6p^5(^2P^\circ_{1\frac{1}{2}})6d$	$6d\ [0\frac{1}{2}]^\circ$	0	*67906.52*
$3d_5$			1	*68891.34*
$3d_4'$	"	$6d\ [3\frac{1}{2}]^\circ$	4	*69798.00*
$3d_4$			3	*70440.42*
$3d_3$	$6p^5(^2P^\circ_{1\frac{1}{2}})6d$	$6d\ [1\frac{1}{2}]^\circ$	2	*70222.82*
			1	
$3p_{10}$	$6p^5(^2P^\circ_{1\frac{1}{2}})8p$	$8p\ [0\frac{1}{2}]$	1	77039.38
$3p_9$	"	$8p\ [2\frac{1}{2}]$	2	77161.69
$3p_8$			3	77604.53
$3p_7$	"	$8p\ [1\frac{1}{2}]$	1	77677.83
$3p_6$			2	77827.82
$3p_5$	"	$8p\ [0\frac{1}{2}]$	0	78163.27
$4d_6$	$6p^5(^2P^\circ_{1\frac{1}{2}})7d$	$7d\ [0\frac{1}{2}]^\circ$	0	*77594.82*
$4d_5$			1	*77816.12*
$4d_4'$	"	$7d\ [3\frac{1}{2}]^\circ$	4	*78088.42*
$4d_4$			3	*78230.67*
$4d_3$	"	$7d\ [1\frac{1}{2}]^\circ$	2	*78173.30*
$4d_2$			1	
$4d_1''$	"	$7d\ [2\frac{1}{2}]^\circ$	2	*78475.97*
$4d_1'$			3	*78628.28*

Rn I—Continued

Author	Config.	Desig.	J	Level
$3s_5$	$6p^5(^2P^\circ_{1\frac{1}{2}})9s$	$9s\ [1\frac{1}{2}]^\circ$	2	*79698.50*
$3s_4$			1	*79762.87*
4X	$6p^5(^2P^\circ_{1\frac{1}{2}})5f$	$5f\ [1\frac{1}{2}]$	1	79639.03
4Y			2	79644.93
	″	$5f\ [4\frac{1}{2}]$	5	
4Z			4	79690.3
4U	″	$5f\ [2\frac{1}{2}]$	3	79745.40
4V			2	79750.02
4W	″	$5f\ [3\frac{1}{2}]$	3	79785.18
			4	
$4p_{10}$	$6p^5(^2P^\circ_{1\frac{1}{2}})9p$	$9p\ [0\frac{1}{2}]$	1	80998.06
$4p_9$	″	$9p\ [2\frac{1}{2}]$	2	81049.29
$4p_8$			3	81253.54
$4p_7$	″	$9p\ [1\frac{1}{2}]$	1	81283.24
$4p_6$			2	81351.52
$4p_5$	″	$9p\ [0\frac{1}{2}]$	0	81510.27
$5d_6$	$6p^5(^2P^\circ_{1\frac{1}{2}})8d$	$8d\ [0\frac{1}{2}]^\circ$	0	*81234.15*
$5d_5$			1	*81329.96*
$5d_4'$	″	$8d\ [3\frac{1}{2}]^\circ$	4	
$5d_4$			3	*81514.40*
$5d_3$	″	$8d\ [1\frac{1}{2}]^\circ$	2	*81490.50*
$5d_2$			1	*81966.30*
$5d_1''$	″	$8d\ [2\frac{1}{2}]^\circ$	2	*81619.30*
$5d_1'$			3	*81695.16*
5X	$6p^5(^2P^\circ_{1\frac{1}{2}})6f$	$6f\ [1\frac{1}{2}]$	1	82190.55
5Y			2	82195.97
	″	$6f\ [4\frac{1}{2}]$	5	
5Z			4	82218.92
5U	″	$6f\ [2\frac{1}{2}]$	3	82246.73
5V			2	82251.06
5W	″	$6f\ [3\frac{1}{2}]$	3	82270.68
			4	
$4s_5$	$6p^5(^2P^\circ_{1\frac{1}{2}})10s$	$10s\ [1\frac{1}{2}]^\circ$	2	*82211.18*
$4s_4$			1	*82275.97*
$5p_{10}$	$6p^5(^2P^\circ_{1\frac{1}{2}})10p$	$10p\ [0\frac{1}{2}]$	1	82927.18
$5p_9$	″	$10p\ [2\frac{1}{2}]$	2	82953.90
$5p_8$			3	83064.98
$5p_7$	″	$10p\ [1\frac{1}{2}]$	1	83079.34
$5p_6$			2	83116.71
$5p_5$	″	$10p\ [0\frac{1}{2}]$	0	83203.97
$6d_6$	$6p^5(^2P^\circ_{1\frac{1}{2}})9d$	$9d\ [0\frac{1}{2}]^\circ$	0	*83042.53*
$6d_5$			1	*83096.24*
$6d_4'$	″	$9d\ [3\frac{1}{2}]^\circ$	4	*83172.08*
$6d_4$			3	*83199.40*
$6d_3$	″	$9d\ [1\frac{1}{2}]^\circ$	2	*83186.66*
$6d_2$			1	*83449.38*
$6d_1''$	″	$9d\ [2\frac{1}{2}]^\circ$	2	*83254.04*
$6d_1'$			3	*83297.22*

Rn I—Continued

Author	Config.	Desig.	J	Level
6X	$6p^5(^2P^\circ_{1\frac{1}{2}})7f$	$7f\ [1\frac{1}{2}]$	1	83575.07
6Y			2	83578.55
	″	$7f\ [4\frac{1}{2}]$	5	
6Z			4	83592.53
6U	″	$7f\ [2\frac{1}{2}]$	3	83607.96
6V			2	83610.71
6W	″	$7f\ [3\frac{1}{2}]$	3	83622.40
			4	
$5s_5$	$6p^5(^2P^\circ_{1\frac{1}{2}})11s$	$11s\ [1\frac{1}{2}]^\circ$	2	*83595.18*
$5s_4$			1	*83630.49*
$7d_6$	$6p^5(^2P^\circ_{1\frac{1}{2}})10d$	$10d\ [0\frac{1}{2}]^\circ$	0	*84075.08*
$7d_5$			1	*84111.60*
$7d_4'$	″	$10d\ [3\frac{1}{2}]^\circ$	4	*84162.11*
$7d_4$			3	*84177.33*
$7d_3$	″	$10d\ [1\frac{1}{2}]$	2	*84169.80*
$7d_2$			1	
$7d_1''$	″	$10d\ [2\frac{1}{2}]^\circ$	2	*84210.00*
$7d_1'$			3	*84236.50*
$6p_9$	$6p^5(^2P^\circ_{1\frac{1}{2}})11p$	$11p\ [2\frac{1}{2}]$	2	
$6p_8$			3	84099.35
$6p_7$	″	$11p\ [1\frac{1}{2}]$	1	84108.5
$6p_6$			2	84131.6
$6p_5$	″	$11p\ [0\frac{1}{2}]$	0	84183.06
7X	$6p^5(^2P^\circ_{1\frac{1}{2}})8f$	$8f\ [1\frac{1}{2}]$	1	84407.70
7Y			2	84410.41
	″	$8f\ [4\frac{1}{2}]$	5	
7Z			4	84419.04
$6s_5$	$6p^5(^2P^\circ_{1\frac{1}{2}})12s$	$12s\ [1\frac{1}{2}]^\circ$	2	*84428.40*
$6s_4$			1	
$7p_9$	$6p^5(^2P^\circ_{1\frac{1}{2}})12p$	$12p\ [2\frac{1}{2}]$	2	
$7p_8$			3	84746.35
$7p_7$	″	$12p\ [1\frac{1}{2}]$	1	
$7p_6$			2	84767.3
$8d_4'$	$6p^5(^2P^\circ_{1\frac{1}{2}})11d$	$11d\ [3\frac{1}{2}]^\circ$	4	*84785.83*
$8d_4$			3	*84795.53*
$8d_3$	″	$11d\ [1\frac{1}{2}]^\circ$	2	*84791.24*
$8d_2$			1	
$8d_1''$	″	$11d\ [2\frac{1}{2}]^\circ$	2	*84816.50*
$8d_1'$			3	*84833.91*
	$6p^5(^2P^\circ_{1\frac{1}{2}})9f$	$9f\ [4\frac{1}{2}]$	5	
8Z			4	84954.68
8U	″	$9f\ [2\frac{1}{2}]$	3	84960.71
			2	
$9d_4'$	$6p^5(^2P^\circ_{1\frac{1}{2}})12d$	$12d\ [3\frac{1}{2}]^\circ$	4	*85204.47*
$9d_4$			3	*85210.91*
	$6p^5(^2P^\circ_{1\frac{1}{2}})10f$	$10f\ [4\frac{1}{2}]$	5	
9Z			4	85322.08
	Rn II $(^2P^\circ_{1\frac{1}{2}})$	*Limit*	-------	86692.5

February 1955.

Rn I Observed Levels*

Configuration $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10} 4f^{14} 5s^2 5p^6 5d^{10} 6s^2+$	Observed Terms										
$6p^6$	$6p^6\ ^1S$										
	ns ($n \geq 7$)	np ($n \geq 7$)				nd ($n \geq 6$)			nf ($n \geq 5$)	
$6p^5(^2P^\circ)nx$	7, 9–12s $^3P^\circ$	7–10p ^3S	7–11p ^3P	7–12p ^3D 7–10p ^1D		6–11d $^3P^\circ$	7–11d $^3D^\circ$	6–12d $^3F^\circ$	5–9f ^3D	5–10f ^3F
Jl Coupling Notation											
	Observed Pairs										
	ns ($n \geq 7$)	np ($n \geq 7$)				nd ($n \geq 6$)			nf ($n \geq 5$)	
$6p^5(^2P_{1\frac{1}{2}})nx$	7, 9–12s[1½]°	7–11p[0½] 7–12p[2½] 7–12p[1½]				6–10d[0½]° 6–12d[3½]° 6–11d[1½]° 7–11d[2½]°			5–9f[1½] 5–10f[4½] 5–7, 9f[2½] 5–7f[3½]	

*For predicted levels in the spectra of the Rn I isoelectronic sequence, see Vol. III, Introduction.

Rn II

(At I sequence; 85 electrons) $Z=86$

Ground state $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10} 4f^{14} 5s^2 5p^6 5d^{10} 6s^2 6p^5\ ^2P^\circ_{1\frac{1}{2}}$

$6p^5\ ^2P^\circ_{1\frac{1}{2}}$ K I. P. volts

The spectrum is still unknown. Edlén has suggested that the one unclassified line at 3235.83 A, listed by Rasmussen as Rn I, may be Rn II. In discussing magnetic-dipole transitions in the configurations $5p^5$ and $6p^5$ of xenon and radon, Edlén states that although the interval of the ground term in Rn II is not known, "an approximate value around 31,000 cm^{-1} was indirectly deduced from a certain perturbation in the observed md_4 series of Rn I." The wave number of the above line is 30895.1, and the transition probability is given by Edlén as 531 sec^{-1}. "The clue to the analysis of Rn II" may be, therefore, to start with the term:

Desig.	J	Level	Interval
$6p^5\ ^2P^\circ$	1½ 0½	*0.0* *30895.1*	−30895.1

REFERENCE

B. Edlén, Phys. Rev. 65, 248, 1944. (C L)

February 1955.

RADIUM

Ra I

88 electrons $Z=88$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^{10}\ 6s^2\ 6p^6\ 7s^2\ {}^1S_0$

$7s^2\ {}^1S_0$ **42577.35 K** I. P. 5.277 volts

The analysis is from Rasmussen, with the revisions suggested by Russell on the basis of the comparison of Ra I with the analogous spectra Be I, Mg I, Ca I, Sr I, and Ba I. In the first column of the table Rasmussen's notation is entered. The changes in analysis can be detected by comparing the designations in this column with those in column three.

There are 69 classified lines between 2955.65 A and 9932.21 A. Observed intersystem combinations connect the singlet and triplet systems of terms.

The limit is from the ${}^3F^\circ$ series. Rasmussen's value has been increased by 627.66 K to agree with the revisions introduced by Russell in the connection between certain groups of terms.

REFERENCES

E. Rasmussen, Zeit. Phys. **87**, 607 (1934). (I P) (T) (C L)
H. N. Russell, Phys. Rev. **46**, 989 (1934). (I P) (T) (C L)

Ra I

Author	Config.	Desig.	J	Level	Interval
1 ${}^1S_0$	$7s^2$	$7s^2\ {}^1S$	0	0.00	
2 ${}^3P_0$	$7s({}^2S)7p$	$7p\ {}^3P^\circ$	0	*13078.44*	920.94
2 ${}^3P_1$			1	*13999.38*	2689.16
2 ${}^3P_2$			2	*16688.54*	
3 ${}^3D_1$	$7s({}^2S)6d$	$6d\ {}^3D$	1	13715.85	278.12
3 ${}^3D_2$			2	13993.97	713.38
3 ${}^3D_3$			3	14707.35	

Ra I

Author	Config.	Desig.	J	Level	Interval
3 ${}^1D_2$	$7s({}^2S)6d$	$6d\ {}^1D$	2	17081.45	
2 ${}^1P_1$	$7s({}^2S)7p$	$7p\ {}^1P^\circ$	1	*20715.71*	
2 ${}^3S_1$	$7s({}^2S)8s$	$8s\ {}^3S$	1	26754.05	
$dp\ {}^3F_2$	$6d({}^2D)7p$	$7p'\ {}^3F^\circ$	2	*28038.05*	2079.73
$dp\ {}^3F_3$			3	*30117.78*	2250.00
$dp\ {}^3F_4$			4	*32367.78*	

Ra I—Continued

Author	Config.	Desig.	J	Level	Interval
$dp\ ^1D_2$	$6d(^2D)7p$	$7p'\ ^1D^\circ$	2	*30918.14*	
	$7s(^2S)8p$	$8p\ ^3P^\circ$	0	*31085.88*	
$dp\ ^3P_1$			1	*31563.29*	477.41
			2	*31874.44*	311.15
	$7p^2$	$7p^2\ ^3P$	0		
$4\ ^3D_1$			1	31248.61	
$dd\ ^3P_2$			2	32941.13	1692.52
$dd\ ^3P_1$	$7s(^2S)7d$	$7d\ ^3D$	1	32000.82	
$4\ ^3D_2$			2	31993.41	−7.41
$4\ ^3D_3$			3	32197.28	203.87
$dd\ ^1D_2$	$7p^2$	$7p^2\ ^1D$	2	32214.84	
$dp\ ^3D_1$	$6d(^2D)7p$	$7p'\ ^3D^\circ$	1	*32229.97*	
$dp\ ^3D_2$			2	*32506.59*	276.62
$dp\ ^3D_3$			3	*33197.46*	690.87
$3\ ^1P_1$	$7s(^2S)8p$	$8p\ ^1P^\circ$	1	*32857.68*	
	$6d(^2D)7p$	$7p'\ ^3P^\circ$	0	*33782.41*	
			1	*33823.70*	41.29
$dp\ ^3P_2$			2	*34382.91*	559.21

Ra I—Continued

Author	Config.	Desig.	J	Level	Interval
$3\ ^3S_1$	$7s(^2S)9s$	$9s\ ^3S$	1	34475.78	
$4\ ^3F_2$	$7s(^2S)5f$	$5f\ ^3F^\circ$	2	*35255.65*	
$4\ ^3F_3$			3	*35268.02*	12.37
$4\ ^3F_4$			4	*35294.40*	26.38
	$7s(^2S)6f$	$6f\ ^3F^\circ$	2		
$5\ ^3F_3$			3	*37922.26*	
$5\ ^3F_4$			4	*37929.64*	7.38
	$7s(^2S)7f$	$7f\ ^3F^\circ$	2		
$6\ ^3F_3$			3	*39360.96*	
$6\ ^3F_4$			4	*39366.98*	6.02
$7\ ^3F_2$	$7s(^2S)8f$	$8f\ ^3F^\circ$	2	*40819.5*	
$7\ ^3F_3$			3	*40819.5*	0.0
$7\ ^3F_4$			4	*40831.58*	12.1
	Ra II ($^2S_{1/2}$)	*Limit*	...	42577.35	

March 1955.

Ra I Observed Terms*

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^{10}\ 6s^2\ 6p^6+$	Observed Terms			
$7s^2$	$7s^2\ ^1S$			
$7p^2$	$7p^2\ ^3P$ $7p^2\ ^1D$			
	$ns\ (n \geq 7)$	$np\ (n \geq 7)$	$nd\ (n \geq 6)$	$nf\ (n \geq 5)$
$7s(^2S)nx$	$8, 9s\ ^3S$	$7, 8p\ ^3P^\circ$ $7, 8p\ ^1P^\circ$	$6, 7d\ ^3D$ $6d\ ^1D$	$5–8f\ ^3F^\circ$
$6d(^2D)nx'$		$7p'\ ^3P^\circ$ $7p'\ ^3D^\circ$ $7p'\ ^1D^\circ$ $7p'\ ^3F^\circ$		

*For predicted terms in the spectra of the Ra I isoelectronic sequence, see Vol. III, Introduction.

Ra II

(Fr I sequence; 87 electrons) $Z=88$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^{10}\ 6s^2\ 6p^6\ 7s\ {}^2S_{½}$

$7s\ {}^2S_{½}$ 81842.31 K I. P. 10.144 volts

The analysis is by Rasmussen, who has classified 64 lines in the range 1888.7 A to 9453.57 A, from observations made with a hollow-cathode source. The spectrum gives well-established series of doublet terms. Rasmussen stresses the similarity of this spectrum and Ba II.

Revised values of the $6f\ {}^2F^\circ$ term are from the infrared combination with $7d\ {}^2D$ given in the later reference.

REFERENCES

E. Rasmussen, Zeit. Phys. 86, 24 (1933). (I P) (T) (C L)
E. Rasmussen, Zeit. Phys. 87, 615 (1934). (C L)

Ra II

Config.	Desig.	J	Level	Interval
$6p^6(^1S)7s$	$7s\ ^2S$	0½	0.00	
$6p^6(^1S)6d$	$6d\ ^2D$	1½ 2½	12084.38 13743.11	1658.73
$6p^6(^1S)7p$	$7p\ ^2P^\circ$	0½ 1½	*21351.20* *26208.86*	4857.66
$6p^6(^1S)8s$	$8s\ ^2S$	0½	43405.01	
$6p^6(^1S)7d$	$7d\ ^2D$	1½ 2½	48744.04 49240.48	496.44
$6p^6(^1S)5f$	$5f\ ^2F^\circ$	2½ 3½	*48987.98* *49272.31*	284.33
$6p^6(^1S)8p$	$8p\ ^2P^\circ$	0½ 1½	*50606.01* *52392.05*	1786.04
$6p^6(^1S)9s$	$9s\ ^2S$	0½	59165.23	
$6p^6(^1S)6f$	$6f\ ^2F^\circ$	2½ 3½	*59515.48* *59815.59*	300.11
$6p^6(^1S)8d$	$8d\ ^2D$	1½ 2½	61734.88 61973.82	238.94
$6p^6(^1S)9p$	$9p\ ^2P^\circ$	0½ 1½	 *63410.41*	
$6p^6(^1S)5g$	$5g\ ^2G$	3½, 4½	64150.65	
$6p^6(^1S)7f$	$7f\ ^2F^\circ$	2½ 3½	*66521.86* *66691.22*	169.36
$6p^6(^1S)10s$	$10s\ ^2S$	0½	66837.88	
$6p^6(^1S)9d$	$9d\ ^2D$	1½ 2½	68264.07 68394.86	130.79
$6p^6(^1S)6g$	$6g\ ^2G$	3½, 4½	69560.85	
$6p^6(^1S)11s$	$11s\ ^2S$	0½	71172.92	
$6p^6(^1S)10d$	$10d\ ^2D$	1½ 2½	72043.06 72123.78	80.72
$6p^6(^1S)7g$	$7g\ ^2G$	3½, 4½	72824.37	
$6p^6(^1S)11d$	$11d\ ^2D$	1½ 2½	74434.04 74488.51	54.47
$6p^6(^1S)8g$	$8g\ ^2G$	3½, 4½	74941.91	
$6p^6(^1S)12d$	$12d\ ^2D$	1½ 2½	 76080.74	
$6p^6(^1S)9g$	$9g\ ^2G$	3½, 4½	76393.12	
$6p^6(^1S)10g$	$10g\ ^2G$	3½, 4½	77431.81	
$6p^6(^1S)11g$	$11g\ ^2G$	3½, 4½	78195.21	
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Ra III $(^1S_0)$	*Limit*	--------	81842.31	

March 1955.

ACTINIUM

Ac I

89 electrons $Z=89$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^{10}\ 6s^2\ 6p^6\ 7s^2\ 6d\ {}^2D_{1\frac{1}{2}}$

$a\ {}^2D_{1\frac{1}{2}}$ K I. P. volts

The observation, description, and analyses of the emission spectra of actinium have been undertaken especially for inclusion here. The analysis is by Meggers, who has measured and interpreted arc and hollow-cathode spectrograms made at the Argonne National Laboratory by Fred and Tomkins. Thus far, 87 Ac I lines, with wavelengths ranging from 2968.82 A to 7866.10 A, have been classified as combinations among 40 energy levels. An estimated value of $z\ {}^2P^{\circ}_{1\frac{1}{2}}$ is entered in brackets in the table. This term has not yet been found because of the lack of infrared observations.

No series have been found. From a study of the screening constants, Finkelnburg and Humbach have extrapolated an ionization potential of 6.9±0.6 volts.

REFERENCES

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M. Fred, F. S. Tomkins, and W. F. Meggers, Phys. Rev. **98**, 1514 (L) (1955). (hfs)
W. Finkelnburg und W. Humbach, Naturwiss. **42**, 35 (1955). (I P)
W. F. Meggers, M. Fred, and F. S. Tomkins, J. Research Nat. Bur. Std. **58**, 297, RP2763 (1957). (T) (C L)

Ac I

Config.	Desig.	J	Level	Interval
$6d\,7s^2$	$a\ {}^2D$	1½	0.00	
		2½	2231.43	2231.43
$6d^2(a\ {}^3F)7s$	$a\ {}^4F$	1½	9217.28	
		2½	9863.59	646.31
		3½	10906.02	1042.43
		4½	12078.07	1172.05
$7s^2(a\ {}^1S)7p$	$z\ {}^2P^{\circ}$	0½		
		1½	[10000±]	
$6d\,7s(a\ {}^3D)7p$	$z\ {}^4F^{\circ}$	1½	*13712.90*	
		2½	*14940.72*	1227.82
		3½	*17683.87*	2743.15
		4½		
$6d\,7s(a\ {}^3D)7p$	$z\ {}^4D^{\circ}$	0½	*17199.71*	
		1½	*19012.46*	1812.75
		2½	*21195.87*	2183.41
		3½	*23475.94*	2280.07
$6d\,7s(a\ {}^3D)7p$	$z\ {}^2D^{\circ}$	1½	*17736.26*	
		2½	*17950.71*	214.45
$6d\,7s(a\ {}^3D)7p$	$z\ {}^4P^{\circ}$	0½	*22401.52*	
		1½	*22801.10*	399.58
		2½	*23898.86*	1097.76
$6d\,7s(a\ {}^3D)7p$	$z\ {}^2F^{\circ}$	2½	*23916.84*	
		3½	*24969.30*	1052.46
$6d\,7s(a\ {}^3D)7p$	$y\ {}^2P^{\circ}$	0½	*25729.03*	
		1½	*27009.84*	1280.81

Config.	Desig.	J	Level	Interval
$6d\,7s(a\ {}^1D)7p$	$y\ {}^2D^{\circ}$	1½	*26066.04*	
		2½	*26533.16*	467.12
$6d\,7s(a\ {}^1D)7p$	$y\ {}^2F^{\circ}$	2½	*26836.20*	
		3½	*28568.40*	1732.20
$6d\,7s(a\ {}^1D)7p$	$z\ {}^2P^{\circ}$	0½		
		1½	*30396.61*	
$6d^2(a\ {}^3F)7p$	$z\ {}^4G^{\circ}$	2½	*31494.68*	
		3½	*32219.62*	724.94
		4½	*32867.39*	647.77
		5½	*33429.76*	562.37
$6d^2(a\ {}^3F)7p$		1½	*31800.35*	
$6d^2(a\ {}^3F)7p$		2½?	*32495.67*	
$6d^2(a\ {}^3F)7p$		1½	*32918.40*	
$6d^2(a\ {}^3F)7p$		1½	*33673.66*	
$6d^2(a\ {}^3F)7p$		3½	*33756.43*	
$6d^2(a\ {}^3F)7p$		3½	*34360.25*	
$6d^2(a\ {}^3F)7p$		2½	*34658.47*	
$6d^2(a\ {}^3F)7p$		4½	*34788.12*	
$6d^2(a\ {}^3F)7p$		4½	*35870.00*	

June 1957.

Ac I Observed Terms*

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$ $3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}$ $5s^2\ 5p^6\ 5d^{10}\ 6s^2\ 6p^6+$	Observed Terms			
$6d\ 7s^2$	$a\ ^2D$			
	$ns\ (n \geq 7)$	$np\ (n \geq 7)$		
$7s^2(a\ ^1S)nx$				
$6d\ 7s(a\ ^3D)nx$	{	$z\ ^4P^\circ$ $y\ ^2P^\circ$	$z\ ^4D^\circ$ $z\ ^2D^\circ$	$z\ ^4F^\circ$ $z\ ^2F^\circ$
$6d\ 7s(a\ ^1D)nx$		$x\ ^2P^\circ$	$y\ ^2D^\circ$	$y\ ^2F^\circ$
$6d^2(a\ ^3F)nx$	$a\ ^4F$			$z\ ^4G^\circ$

*For predicted terms in the spectra of the Ac I isoelectronic sequence, see Vol. III, Introduction.

Ac II

(Ra I sequence; 88 electrons) $Z=89$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^{10}\ 6s^2\ 6p^6\ 7s^2\ ^1S_0$

$a\ ^1S_0$ **97300** K I. P. 12.1 volts

The analysis is by Meggers, who has measured and interpreted spark and hollow-cathode spectrograms made at the Argonne National Laboratory by Fred and Tomkins. This work has been carried out especially for inclusion here. Meggers has furnished manuscript in advance of publication. He states that "The Ac II spectrum is more complex than Ac I because the $5f$-electron contributes many excited odd levels. Thus far, 226 Ac II lines with wavelengths from 2261.75 A to 7886.82 A have been classified as combinations of 27 even and 38 odd levels."

Racah has suggested the jj-coupling arrangement for the levels from the $5f(^2F^\circ)7p$ configuration. The tentative LS-designations ascribed to these levels agree reasonably well both with the intensities of the observed combinations and with the theory for 2-electron spectra by Racah.

The limit is from the $7s(^2S)ns$ series ($n=7$, 8), and has been derived from a Rydberg formula, corrected by analogy with Ra II. From a study of screening constants Finkelnburg and Humbach interpolate an ionization potential of 11.5 ± 0.4 volts.

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G. Racah, Physica **16**, Nos. 7–8, 651 (1950).
W. F. Meggers, M. Fred, and F. S. Tomkins, J. Opt. Soc. Am. **41**, 867 (A) (1951). (T)
M. Fred, F. S. Tomkins, and W. F. Meggers, Phys. Rev. **98**, 1514 (L) (1955). (hfs)
W. Finkelnburg und W. Humbach, Naturwiss. **42**, 35 (1955). (I P)
W. F. Meggers, M. Fred, and F. S. Tomkins, J. Research Nat. Bur. Std. **58**, 297, RP2763 (1957). (I P) (T) (C L)

Ac II

Config.	Desig.	J	Level	Interval
$7s^2$	$a\ ^1S$	0	0.00	
$6d(^2D)7s$	$a\ ^3D$	1	4739.63	527.53
		2	5267.16	2159.36
		3	7426.52	
$6d(^2D)7s$	$a\ ^1D$	2	9087.54	
$6d^2$	$a\ ^3F$	2	13236.46	1712.75
		3	14949.21	1807.69
		4	16756.90	
$6d^2$	$a\ ^3P$	0	17737.10	1278.22
		1	19015.32	3184.13
		2	22199.45	
$6d^2$	$b\ ^1D$	2	19203.02	
$6d^2$	$a\ ^1G$	4	20848.23	
$7s(^2S)7p$	$z\ ^3P^\circ$	0	20956.40	1224.12
		1	22180.52	9698.35
		2	31878.87	
$6d(^2D)7p$	$z\ ^3F^\circ$	2	26446.96	4727.64
		3	31174.60	7944.42
		4	39119.02	
$7s(^2S)5f$	$y\ ^3F^\circ$	2	28201.11	1679.98
		3	29881.09	3084.46
		4	32965.55	
$6d(^2D)7p$	$z\ ^3D^\circ$	1	29250.40	4054.56
		2	33304.96	3667.98
		3	36972.94	
$7s(^2S)7p$	$z\ ^1P^\circ$	1	33388.61	
$6d(^2D)7p$	$z\ ^1D^\circ$	2	35397.12	
$7s(^2S)5f$	$z\ ^1F^\circ$	3	36144.35	
$6d(^2D)7p$	$y\ ^3P^\circ$	0	36780.01	75.49
		1	36855.50	1516.14
		2	38371.64	
$6d(^2D)5f$	$z\ ^3H^\circ$	4	39807.14	1109.27
		5	40916.41	
		6		
$6d(^2D)5f$	$x\ ^3F^\circ$	2	41578.57	1697.28
		3	43275.85	1764.45
		4	45040.30	
$6d(^2D)5f$	$z\ ^1G^\circ$	4	41627.79	
$6d(^2D)7p$	$y\ ^1F^\circ$	3	41957.05	
$6d(^2D)7p$	$y\ ^1P^\circ$	1	44199.94	
$6d(^2D)5f$	$y\ ^1D^\circ$	2	44705.33	
$6d(^2D)5f$	$z\ ^3G^\circ$	3	45807.06	1620.61
		4	47427.67	1723.87
		5	49151.54	
$6d(^2D)5f$	$y\ ^3D^\circ$	1	48518.41	960.64
		2	49479.05	580.65
		3	50059.70	
$6d(^2D)5f$	$x\ ^3P^\circ$	0	49780.60	455.00
		1	50235.60	1021.91
		2	51257.51	
$7s(^2S)8s$	$e\ ^3S$	1	51680.55	
$6d(^2D)5f$	$x\ ^1F^\circ$	3	53255.30	
$7s(^2S)8s$	$e\ ^1S$	0	53374.01	
$5f(^2F^\circ_{2\frac{1}{2}})7p_{\frac{1}{2}}$	$e\ ^3F$	2	54633.05	
"	$e\ ^3G$	3	54644.11	
$6d(^2D)5f$	$x\ ^1P^\circ$	1	56152.2	
$5f(^2F^\circ_{3\frac{1}{2}})7p_{\frac{1}{2}}$	$e\ ^3G$	4	57683.78	
"	$e\ ^3D$	3	57944.57	
$5f(^2F^\circ_{2\frac{1}{2}})7p_{1\frac{1}{2}}$	$e\ ^3F$	3	59071.9	
"	$e\ ^3D$	2	59807.5	
"	$e\ ^1G$	4	59889.05	
"	$e\ ^3D$	1	60063.0	
$5f(^2F^\circ_{3\frac{1}{2}})7p_{1\frac{1}{2}}$	$e\ ^1F$	3	62350.68	
"	$e\ ^3F$	4	62869.81	
"	$e\ ^1D$	2	63581.56	
"	$e\ ^3G$	5	65392.46	
Ac III ($^1S_{0\frac{1}{2}}$)	*Limit*	------	97300	

June 1957.

Ac II OBSERVED TERMS*

Configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^{10}\ 6s^2\ 6p^6+$	Observed Terms		
$7s^2$	$a\ ^1S$		
$6d^2$	$a\ ^3P$ $b\ ^1D$ $a\ ^3F$ $a\ ^1G$		
	$ns\ (n\geq7)$	$np\ (n\geq7)$	$nf\ (n\geq5)$
$7s(^2S)ns$	$e\ ^3S$ $e\ ^1S$	$z\ ^3P^\circ$ $z\ ^1P^\circ$	$y\ ^3F^\circ$ $z\ ^1F^\circ$
$6d(^2D)ns$	$a\ ^3D$ $a\ ^1D$	$y\ ^3P^\circ$ $z\ ^3D^\circ$ $z\ ^3F^\circ$ $y\ ^1P^\circ$ $z\ ^1D^\circ$ $y\ ^1F^\circ$	$x\ ^3P^\circ$ $y\ ^3D^\circ$ $x\ ^3F^\circ$ $z\ ^3G^\circ$ $z\ ^3H^\circ$ $x\ ^1P^\circ$ $y\ ^1D^\circ$ $x\ ^1F^\circ$ $z\ ^1G^\circ$
$5f(^2F^\circ)ns$		$e\ ^3D$ $e\ ^3F$ $e\ ^3G$ $e\ ^1D$ $e\ ^1F$ $e\ ^1G$	

*For predicted terms in the spectra of the Ra I isoelectronic sequence, see Vol. III, Introduction.

Ac III

(Fr I sequence; 87 electrons) $Z=89$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 4f^{14}\ 5s^2\ 5p^6\ 5d^{10}\ 6s^2\ 6p^6\ 7s\ ^2S_{0\frac{1}{2}}$

$7s\ ^2S_{0\frac{1}{2}}$ K I. P. volts

The analysis is by Meggers, who first detected strong Ac III lines on spark spectrograms made at the Argonne laboratory by Fred and Tomkins. This work has been done especially for inclusion here, and the results have been furnished in advance of publication.

Meggers has ascribed eight lines to Ac III, in the range 2626.44 A to 5193.21 A, because they appeared in the arcs only near the cathode, and were greatly enhanced and hazy in the spark. He reports that two lines exhibit hyperfine components having a separation of 1.73 K, which led him to conclude that they represent the combination from the ground state $7s\ ^2S$ to $7p\ ^2P^\circ$. Further observations over a longer spectral range are needed to extend the analysis.

By analogy with Ra II and Th IV Lang estimates an ionization potential near 20 volts.

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R. J. Lang, Canadian J. Research [A] 14, 46 (1936). (I P).
W. F. Meggers, M. Fred, and F. S. Tomkins, J. Opt. Soc. Am. 41, 867 (A) (1951).
W. F. Meggers, M. Fred, and F. S. Tomkins, J. Research Nat. Bur. Std. 58, 297, RP2763 (1957). (T) (C L) (hfs).

Ac III

Config.	Desig.	J	Level	Interval
$6p^6(^1S)7s$	$7s\ ^2S$	$0\frac{1}{2}$	0.0	
$6p^6(^1S)6d$	$6d\ ^2D$	$1\frac{1}{2}$	801.0	3402.9
		$2\frac{1}{2}$	4203.9	

Ac III

Config.	Desig.	J	Level	Interval
$6p^6(^1S)5f$	$5f\ ^2F^\circ$	$2\frac{1}{2}$	*23454.5*	2625.7
		$3\frac{1}{2}$	*26080.2*	
$6p^6(^1S)7p$	$7p\ ^2P^\circ$	$0\frac{1}{2}$	*29465.9*	8597.1
		$1\frac{1}{2}$	*38063.0*	

June 1957.

Page	Spectrum	Remarks
1	H I	Add references: C. J. Humphreys, J. Research Nat. Bur. Std. **50,** 1, RP 2380 (1953) (T) (C L); Sixth series and other series members in far infrared. W. E. Lamb, Jr. and T. M. Sanders, Jr., Phys. Rev. [2] **103,** 313 (1956); Fine structure of $n=3$.
3	D	Add reference: G. Herzberg, Proc. Roy. Soc. London [A] **234,** 516 (1956); Fine structure.
4	He I	Add references: W. V. Houston, Proc. Nat. Acad. Sci. **13,** 91 (1927); Fine structure. C. J. Humphreys and H. J. Kostkowski, J. Research Nat. Bur. Std. **49,** 73, RP 2345 (1952) (T) (C L); Revised term values from infrared observations. G. Herzberg, Am. Assn. Adv. Sci. Symposium (December 1957) (I P); Limit **198310.4** ±0.3; I. P. 24.581. T. H. Maiman and W. E. Lamb, Jr., Phys. Rev. **98,** 1194 (A) (1955); Fine structure. C. J. Humphreys and E. Paul, Jr., U. S. Naval Ord Lab., NAVORD Report 4589, 25 (1956) (T) (CL); Infrared observations. A. G. Shenstone, unpublished material (1957); Revised level values based on recent observations:

He I **He I**

Desig.	J	Level	Desig.	J	Level
$8s\,^3S$	1	196455.68	$13s\,^3S$	1	197625.00
$8s\,^1S$	0	196529.03	$13s\,^1S$	0	197641.53
$8d\,^3D$	3, 2, 1	196589.26	$13d\,^1D$	2	197655.34
$8d\,^1D$	2	196589.73	$13d\,^3D$	3, 2, 1	197655.38
$9s\,^3S$	1	196856.29	$14s\,^3S$	1	197720.62
$9s\,^1S$	0	196907.13	$14s\,^1S$	0	197733.82
$9d\,^3D$	3, 2, 1	196949.41	$14d\,^1D$	2	197744.84
$9d\,^1D$	2	196949.63	$14d\,^3D$	3, 2, 1	197744.86
$10s\,^3S$	1	197139.53	$15s\,^3S$	1	197797.37
$10s\,^1S$	0	197176.32	$15s\,^1S$	0	197808.10
$10d\,^3D$	3, 2, 1	197207.05	$15d\,^1D$	2	197817.01
$10d\,^1D$	2	197207.22	$15d\,^3D$	3, 2, 1	197817.08
$11s\,^3S$	1	197347.13	$16s\,^3S$	1	197860.11
$11d\,^3D$	3, 2, 1	197397.63	$16d\,^1D$	2	197875.8?
$11d\,^1D$	2	197397.84	$16d\,^3D$	3, 2, 1	197876.17
$12s\,^3S$	1	197503.77	$17s\,^3S$	1	197911.78
$12s\,^1S$	0	197524.83	$17d\,^3D$	3, 2, 1	197925.16
$12d\,^3D$	3, 2, 1	197542.55	$18d\,^3D$	3, 2, 1	197966.4?
$12d\,^1D$	2	197542.69	$19d\,^3D$	3, 2, 1	198001.2?

July 1957.

Page	Spectrum	Remarks
6	He II	J. E. Mack (letter, December 1953) states that the term $15s\,^2S$, etc. should read 436958.026, etc., instead of 436957.026, etc.
		Add references: R. Wilson, Mon. Not. Roy. Astron. Soc. **113,** 557 (1953); Series members $5g\,^2G-nh\,^2H^\circ(n=13$ to $34)$. G. W. Series, Proc. Roy. Soc. London [A] **226,** 377 (1954); Fine structure.
8	Li I	Add reference: K. Lidén and N. Starfelt, Ark. Fys. **5,** 127 (1952) (I P).
10	Li II	$2s\,^1S$ should read 491361 instead of [490079].
		Add reference: H. Schüler, Zeit. Phys. **66,** 431 (1930); Fine structure.

*At the end of Volume II a list of corrections to Volume I was appended. These are not repeated, but additional revisions are given.

Page	Spectrum	Remarks
12	Be I	Add reference: W. R. Bozman, C. H. Corliss, W. F. Meggers and R. E. Trees, J. Research Nat. Bur. Std. **50**, 131, RP 2399 (1953) (T) (C L); Observed intersystem combination gives $x=-1.18$.
14	Be III	Add reference: B. Edlén, Ark. Fys. **4**, No. 28, 441 (1952) (I P) (T) (C L); Revised analysis.
16	B I	Add references: H. E. Clearman, J. Opt. Soc. Am. **42**, 373 (1952) (T) (C L). E. W. Burke, Jr. and J. E. Mack, J. Opt. Soc. Am. **46**, 100 (1956) (T).
19	B IV	Add reference: B. Edlén, Ark Fys. **4**, No. 28, 441 (1952) (I P) (T) (C L); Revised analysis.
21	C I	Limit should read **90814**, I. P. 11.256. Add references: B. Edlén, Accad. Naz. Lincei Volta Conv. (Rome) **11**, 58 (1952) and unpublished material (September 1952); Wavelengths and revised term values. L. Minnhagen, Ark. Fys. **7**, No. 33, 413 (1954) (T) (C L).
24	C II	Add reference: S. Glad, Ark. Fys. **7**, No. 2, 7 (1954) (I P) (T) (C L); Revised analysis.
26	C III	Add reference: K. Bockasten, Ark. Fys. **9**, No. 30, 457 (1955) (I P) (T) (C L); Revised analysis: Revised limit is **386213.9**, I. P. 47.871; $x=+51.7$.
29	C IV	Add reference: K. Bockasten, Ark Fys. **10**, No. 40, 567 (1956) (I P) (T) (C L); Revised analysis.
30	C V	Add reference: B. Edlén, Ark. Fys. **4**, No. 28, 441 (1952) (I P) (T) (C L); Revised analysis.
32	N I	The term $3s'\ {}^2D$ is unresolved and should read 99663. The lack of resolution has been pointed out by J. C. Boyce in private conversation. Add reference: I. S. Bowen, Astroph. J. **121**, 306 (1955) (C L): $2p^3\ {}^2D^\circ_{2\frac{1}{2}}$ should read *19223.9* ${}^2D^\circ_{1\frac{1}{2}}$ should read *19233.1* Limit should read ***117214***, I. P. 14.53.
35	N II	Add reference: I. S. Bowen, Astroph. J. **121**, 306 (1955). (C L) K. B. Eriksson, unpublished material reported by B. Edlén (March 1957); Revised analysis: Revised limit is **238751.1**±1, I. P. 29.593; $x=-382.6$. $4p\ {}^1S_0$ should read 206911.0.
43	N VI	Add reference: B. Edlén, Ark Fys. **4**, No. 28, 441 (1952) (I P) (T) (C L); Revised analysis.
45	O I	Add references: D. O. Davis and K. W. Meissner, J. Opt. Soc. Am. **43**, 510 (1953) Fine structure. G. Kvifte, Ark. Mat. o Naturvidenskab (Oslo) [B] **52**, 65 (1954) (T) (C L); Series extended. I. S. Bowen, Astroph. J. **121**, 306 (1955) (C L).
47	O II	Limit should read ***283244***, I. P. 35.108. Add reference: I. S. Bowen, Astroph. J. **121**, 306 (1955) (C L).
50	O III	Limit should read **442807**, I. P. 54.886. Add reference: I. S. Bowen, Astroph. J. **121**, 306 (1955) (C L).
59	O VII	Add reference: B. Edlén, Ark. Fys. **4**, No. 28, 441 (1952) (I P) (T) (C L); Revised analysis.
66	F IV	Limit should read **703020**, I. P. 87.14. Add reference: I. S. Bowen, Astroph. J. **121**, 306 (1955) (C L).
75	F VIII	Add reference: B. Edlén, Ark. Fys. **4**, No. 28, 441 (1952) (I P) (T) (C L); Revised analysis.
83	Ne III	Add references: I. S. Bowen, Astroph. J. **121**, 306 (1955) (C L): $2p^4\ {}^3P_1$ should read 642.9 $2p^4\ {}^1D_2$ should read 25840.8 W. Finkelnburg und W. Humbach, Naturwiss. **42**, 35 (1955) (I P): Interpolated ionization potential 63.5$\pm$0.1.
84	Ne IV	Limit should read ***782768***, I. P. 97.02. Add reference: I. S. Bowen, Astroph. J. **121**, 306 (1955) (C L): $2p^3\ {}^2D^\circ_{2\frac{1}{2}}$ reads *40950+x* ${}^2D^\circ_{1\frac{1}{2}}$ should read *40995+x* —44.8 $2p^3\ {}^2P^\circ_{0\frac{1}{2}}$ should read *62150+x* ${}^2P^\circ_{1\frac{1}{2}}$ should read *62157+x* 6.4 $2p^4\ {}^2D^\circ_{2\frac{1}{2}}$ should read *253799+x* ${}^2D^\circ_{1\frac{1}{2}}$ should read *253822+x* —23 Other doublet terms should be revised accordingly.

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Page	Spectrum	Remarks
86	Ne v	Limit should read **1018634**, I. P. 126.3. Add reference: I. S. Bowen, Astroph. J. **121**, 306 (1955) (C L).
89	Na I	Add reference: P. Risberg, Ark. Fys. **10**, No. 41, 583 (1956) (I P) (T) (C L) (G D); Revised analysis.
96	Na v	Limit should read ***116312***, I. P. 138.37.
98	Na vi	Limit should read **1388419**, I. P. 172.09.
106	Mg I	Add reference: R. A. Fisher and F. E. Eshbach, J. Opt. Soc. Am. **43**, 1030 (1953) (T) (C L); Revised term values from near infrared observations.
108	Mg II	Add reference: P. Risberg, Ark. Fys. **9**, No. 31, 483 (1955) (I P) (T) (C L) (G D); Revised analysis.
114	Mg vi	Limit should read ***1504581***, I. P. 186.49.
117	Mg vii	Limit should read **1814430**, I. P. 224.90.
123	Mg xi	Add reference: B. Edlén, Ark. Fys. **4**, No. 28, 441 (1952) (I P) (T) (C L); Revised analysis.
135	Al vii	Limit should read ***1947390***, I. P. 241.38.
136	Al viii	Limit should read **2295500**, I. P. 284.53.
143	Al xii	Add reference: B. Edlén, Ark Fys. **4**, No. 28, 441 (1952) (I P) (T) (C L); Revised analysis.
144	Si I	A. G. Shenstone, private communication (October 1957) reports following new terms:

$3s\,3p^3$	$^5S^\circ_2$	*33326.16*	
$3s\,3p^2(^4P)4s$	$^5P_1$	81724.8	
			99.5
	$^5P_2$	81824.3	
			152.2
	$^5P_3$	81976.5	
$3s\,3p^2(^4P)3d$	$^5P_3$	94292.3	
			−73.8
	$^5P_2$	94366.1	
			−47.7
	$^5P_1$	94413.8	

He suggests also, that the term designated $3p^3\ ^3D^\circ$ (*48399.15* etc.) be deleted, and that the series terms $nd\ ^3D^\circ (n=4$ to $8)$ have n decreased by 1, $(n=3$ to $7)$, since the lowest $^3D^\circ$ term has the configuration $3s\,3p^3$.

Add references: M. A. El'yashevich and O. N. Nikitina, Dokl. Akad. Nauk SSSR, **111**, No. 2, 325 (1956); Phys. Abstr. **60**, No. 713, 383 (1957) (T) (C L); Report $3s\,3p^3\ ^5S^\circ_2$ *33326.28*. C. C. Kiess (July 1957), confirms the term $3s\,3p^3\ ^5S^\circ_2$ from two Si I lines he has measured at 3020.020A (20) and 3006.738A (10). The term designated $3d\ ^3D^\circ$ (*45276.20* etc.) should have the configuration $3s\,3p^3$.

Page	Spectrum	Remarks
147	Si II	A. G. Shenstone and S. L. Blatt, letter (Dec. 1957) report the following terms:

$3p$	$^2P^\circ_{0\frac{1}{2}}$	*0.00*		$4p$	$^4P_{0\frac{1}{2}}$	134017.4	
			287.45				62.3
	$^2P^\circ_{1\frac{1}{2}}$	*287.45*			$^4P_{1\frac{1}{2}}$	134079.7	
							134.3
					$^4P_{2\frac{1}{2}}$	134214.0	
$3p^2$	$^4P_{0\frac{1}{2}}$	42824.39					
			108.52				
	$^4P_{1\frac{1}{2}}$	42932.91					
			175.17				
	$^4P_{2\frac{1}{2}}$	43108.08		$4p$	$^4S_{1\frac{1}{2}}$	134906.0	

x is, therefore, approximately -1257 and the values of the quartet terms should be revised to fit the above data.

Page	Spectrum	Remarks
148	Si III	B. Edlén, letter (July 1956) notes that the $3p^2\ ^1D$ and $3d\ ^1D$ terms are dubious.
156	Si viii	Limit should read ***2445110***, I. P. 303.07.
157	Si ix	Limit should read **2831470**, I. P. 350.96.
163	P I	Add reference: W. C. Martin, Dissertation, Princeton University (June 1956) (I P) (T) (C L); Revised analysis: Limit ***84580***, I. P. 10.484.
164	P II	Add reference: W. C. Martin, Dissertation, Princeton University (June 1956); Revised analysis: Limit **159100**, I. P. 19.72; $x=-6753.2$.

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Page	Spectrum	Remarks
166	P III	Add reference: W. C. Martin, unpublished material (February 1957); Revised wavelengths and term values; $4d\ ^2D_{2\frac{1}{2}}$ should read 172428.63 / $^2D_{1\frac{1}{2}}$ should read 172429.40 — −0.77 Add $4p\ ^4D_{3\frac{1}{2}}$ 207036.2 / $^4D_{2\frac{1}{2}}$ 207361.6 — 325.4
168	P IV	W. C. Martin, letter (July 1957); Revised analysis: delete $3d\ ^1D^\circ$ and $5p\ ^3P^\circ$.
174	P IX	Limit should read **2997600**, I. P. 371.6.
176	P X	Limit should read **3423000**, I. P. 424.3.
181	S I	Add reference: I. S. Bowen, Astroph. J. **121**, 306 (1955) (C L).
183	S II	Add reference: I. S. Bowen, Astroph. J. **121**, 306 (1955) (C L): $3p^3\ ^2D^\circ_{1\frac{1}{2}}$ should read *14853.0* / $^2D^\circ_{2\frac{1}{2}}$ should read *14884.8* — 31.8 $3p^3\ ^2P^\circ_{0\frac{1}{2}}$ should read ***24524.9*** / $^2P^\circ_{1\frac{1}{2}}$ should read ***24571.6*** — 46.7
185	S III	Add reference: I. S. Bowen, Astroph. J. **121**, 306 (1955) (C L).
194	S X	Limit should read ***3606000***?, I. P. 447.0?.
195	Cl I	Add reference: S. Avellén, Ark. Fys. **8**, No. 3, 211 (1954) (I P) (T) (C L): $3p^5\ ^2P^\circ_{0\frac{1}{2}}$ should read *882.50*; Limit should read ***104995.46***.
199	Cl III	Add reference: I. S. Bowen, Astroph. J. **121**, 306 (1955) (C L): $3p^3\ ^2D^\circ_{2\frac{1}{2}}$ should read *18118.6*.
201	Cl IV	Add reference: I. S. Bowen, Astroph. J. **121**, 306 (1955) (C L).
210	Cl XI	Add reference: W. Finkelnburg und W. Humbach, Naturwiss. **42**, 35 (1955) (I P): From screening constants, interpolated I. P. is 530.9±0.2.
211	Ar I	Add references: C. J. Humphreys and H. J. Kostkowski, J. Research Nat. Bur. Std. **49**, 73, RP 2345 (1952) (C L); Infrared observations. T. A. Littlefield and D. T. Turnbull, Proc. Roy. Soc. London [A] **218**, 577 (1953) (T) (C L). K. Burns and K. B. Adams, J. Opt. Soc. Am. **43**, 1020 (1953) (T) (C L); Revised level values. G. H. Dieke and H. M. Crosswhite, Ordnance Project No. TB 2-0001 (488) 38 pp. (1954) (C L); Bibliography, wavelength list, intensities. C. J. Humphreys and E. Paul, Jr., U. S. Naval Ord. Lab., NAVORD Report 4589, 40 (1956) (T) (C L); Infrared observations.
218	Ar III	Add reference: I. S. Bowen, Astroph. J. **121**, 306 (1955) (C L): $3p^4\ ^3P_1$ should read 1112.1 $3p^4\ ^1D_2$ should read 14010.0 $3p^4\ ^1S_0$ should read 33265.7
220	Ar IV	Add reference: I. S. Bowen, Astroph. J. **121**, 306 (1955) (C L): $3p^3\ ^2D^\circ_{1\frac{1}{2}}$ should read *21090.3* / $^2D^\circ_{2\frac{1}{2}}$ should read *21219.5* — 129.2 $3p^3\ ^2P^\circ_{0\frac{1}{2}}$ should read *34855.4* / $^2P^\circ_{1\frac{1}{2}}$ should read *35032.7* — 177.3
222	Ar V	Add reference: I. S. Bowen, Astroph. J. **121**, 306 (1955) (C L): new term $3p^2\ ^1S_0$ 37914.
225	Ar IX	Add reference: W. Finkelnburg und W. Humbach, Naturwiss. **42**, 35 (1955) (I P): From screening constants interpolated I. P. is 422.6±0.2.
226	Ar XIV	Add reference: B. Edlén, Mon. Not. Roy. Astron. Soc. **114**, 700 (1954) (T); Interval of ground term of A XIV should read 22657, derived from the coronal line observed at λ4412.4A, which replaces λ4359 previously identified as [A XIV].

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Page	Spectrum	Remarks
227	K I	Add reference: P. Risberg, Ark. Fys. **10,** No. 41, 594 (1956) (I P) (T) (C L) (G D); Revised analysis.
233	K IV	Add reference: I. S. Bowen, Astroph. J. **121,** 306 (1955) (C L): $3p^4\ ^1D_2$ should read 16384. 0 $3p^4\ ^1S_0$ should read 38546
234	K V	Add references: W. Finkelnburg und W. Humbach, Naturwiss. **42,** 35 (1955) (I P): From screening constants, interpolated I. P. is 82.6±0.4. I. S. Bowen, Astroph. J. **121,** 306 (1955) (C L): $3p^3\ ^2D^\circ_{1\frac{1}{2}}$ should read *24012. 7* $^2D^\circ_{2\frac{1}{2}}$ should read *24249. 5* 236. 8
245	Ca II	Add reference: B. Edlén and P. Risberg, Ark. Fys. **10,** No. 39, 553 (1956) (I P) (T) (C L) (G D); Revised analysis.
249	Ca V	Add reference: I. S. Bowen, Astroph. J. **121,** 306 (1955) (C L): $3p^4\ ^3P_1$ should read 2406. 0 $3p^4\ ^1D_2$ should read 18830. 1
251	Ca VI	Add reference: W. Finkelnburg und W. Humbach, Naturwiss. **42,** 35 (1955) (I P): From screening constants, interpolated I. P. is 109±1.
253	Ca VIII	Add reference: W. Finkelnburg und W. Humbach, Naturwiss. **42,** 35 (1955) (I P): From screening constants, interpolated I. P. is 143.3±0.4.
258	Ca XV	Add reference: B. Edlén, Mon. Not. Roy. Astron. Soc. **114,** 700 (1954) (T): From coronal observations, ground term of Ca XV is: $2p^2\ ^3P$ 0 0 1 17556 17556 2 35911 18355
259	Sc I	Add reference: M. A. Catalán y R. Velasco, An. Real. Soc. Esp. [A] **48,** 247 (1952) (I P): Revised limit **52750,** I. P. 6.54.
263	Sc III	Add reference: M. A. Catalán y R. Velasco, An. Real. Soc. Esp. [A] **48,** 247 (1952) (I P).
267	Sc VII	Add reference: W. Finkelnburg und W. Humbach, Naturwiss. **42,** 35 (1955) (I P): From screening constants, interpolated I. P. is 139±1.
268	Sc VIII	I. S. Bowen in conversation (July 1953) has noted that the analysis is incorrect.
273	Ti I	Add references: M. A. Catalán y R. Velasco, An. Real. Soc. Esp. [A] **48,** 247 (1952) (I P): Revised limit **55010,** I. P. 6.82. A. K. Wardakee, J. Opt. Soc. Am. **45,** 354 (1955) (C L).
281	Ti III	Add reference: M. A. Catalán y R. Velasco, An. Real. Soc. Esp. [A] **48,** 247 (1952) (I P). The *J*-value for $e\ ^3S$ should read "1".
287	Ti VIII	I. S. Bowen in conversation (July 1953) has noted that the analysis is incorrect. Add reference: W. Finkelnburg u W. Humbach, Naturwiss. **42,** 35 (1955) (I P): From screening constants, interpolated I. P. is 172±1.
288	Ti X	Add reference: W. Finkelnburg u W. Humbach, Naturwiss. **42,** 35 (1955) (I P): From screening constants, interpolated I. P. is 216.9±0.6.
301	V III	Add reference: M. A. Catalán y R. Velasco, An. Real. Soc. Esp [A] **48,** 247 (1952) (I P).
XXXVI	Sc I sequence	For configurations having F-limit terms, under "*nf*" add S° and P° as predicted terms; for those having G-limit terms, add P° and D° as predicted terms.

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NOTE ADDED IN PROOF

124	Al/I	B. Edlén (letter, February, 1958) states that the term 38929.42 etc. designated $4d\ ^2D$ should be assigned to $3s\,3p^2$, and, consequently, the *n*-values for all higher $nd\ ^2D$ terms should be decreased by one unit.
266	Sc VI	Add reference: B. Eldén, Phys. Rev. **62,** 434 (1942) (T): $3s\,3p^6\ ^1P_1^\circ$ *224474*.

Page	Spectrum	Remarks
1	Cr I	Add references: C. C. Kiess, J. Research Nat. Bur. Std. **51,** 247, RP 2457 (1953) (I P) (T) (C L) (Z E). P. Brix, J. T. Eisinger, H. Lew, and G. Wessel, Phys. Rev. [2] **92,** 647 (1953) (Z E).
10	Cr II	In the array of observed terms the second entry under "Config." should read $3d^3\,4s^2$ instead of $3d^3\,4s$. G. Racah (1953) has suggested that the configuration of the term $c\,^4$P should read $3d^4(b\,^3\text{P})4s$ instead of $3d^3\,4s^2$.
14	Cr III	Add references: M. A. Catalán y R. Velasco, An. Real. Soc. Esp. [A] **48,** 247 (1952) (I P). F. L. Moore, Jr. (Thesis, Princeton 1949), Univ. Microfilm Publ. No. 10, 972, 172 pp.; Dissertation Abstract (Ann Arbor, Mich.) **15,** 432 (1955) (I P) (T) (C L).
27	Mn I	Add references: M. A. Catalán, J. Research Nat. Bur. Std. **47,** 502, RP 2278 (1951) (Z E). M. L. Espinosa, An. Real. Soc. Esp. [A] **48,** 223 (1952) (Z E). M. A. Catalán (1953) in private conversation has suggested that the term $c\,^4$F is somewhat dubious.
32	Mn II	Add references: R. E. Trees, Phys. Rev. [2] **83,** 756 (1951): Notes that the configurations of $a\,^3$G and $b\,^3$G as published in "AEL" should be interchanged in accordance with Curtis' 1952 paper. O. García-Riquelme, L. Iglesias, y R. Velasco, An. Real. Soc. Esp. [A] **53,** 77 (1957) (I P) (T) (C L). L. Iglesias, J. Opt. Soc. Am. **46,** 449 (1956); **47,** 852 (1957) (T) (C L) (E D).
40	Mn V	Add reference: I. S. Bowen, Astroph. J. **121,** 306 (1955) (C L).
41	Mn VI	Add reference: I. S. Bowen, Astroph. J. **121,** 306 (1955) (C L).
49	Fe I	Add references: M. A. Catalán y R. Velasco, An. Real. Soc. Esp. [A] **48,** 247 (1952) (I P). B. Edlén, Trans. Intern. Astron. Union **9,** 219 (1955) (T); Revised term values. J. Blackie and T. A. Littlefield, Proc. Roy. Soc. London [A] **234,** 398 (1956) (C L).
55	Fe II	Add reference: M. Sales, An. Real. Soc. Esp. [A] **49,** 15 (1953) (T) (C L) (E D).
60	Fe III	Add references: R. E. Trees, Phys. Rev. [2] **84,** 1089 (1951) (T). I. S. Bowen, Astroph. J. **121,** 306 (1955) (C L). S. Glad, Ark. Fys. **10,** No. 22, 291 (1956) (I P) (T) (C L) (E D); Extension of analysis.
66	Fe V	Add reference: I. S. Bowen, Astroph. J. **121,** 306 (1955) (C L).
67	Fe VI	Add reference: I. S. Bowen, Astroph. J. **121,** 306 (1955) (C L): The following terms should read: $a\,^4$F 1½ 0.0 2½ 510.9 (interval 510.9) 3½ 1189 (interval 678) 4½ 2002 (interval 813) $a\,^4$P 0½ 18738.1 1½ 18943 (interval 205) 2½ 19612 (interval 669) $a\,^2$G 3½ 20617 4½ 21315 (interval 698)
69	Fe VII	Add reference: I. S. Bowen, Astroph. J. **121,** 306 (1955) (C L): The following terms should read: $a\,^3$F 2 0.0 3 1050.2 (interval 1050.2) 4 2326 (interval 1276) $a\,^1$D 2 17474.3 $a\,^3$P 1 20428.5 2 21270 (interval 842)

Page	Spectrum	Remarks
78	Co I	Add reference: M. A. Catalán y R. Velasco, An. Real. Soc. Esp. [A] **48**, 247 (1952) (I P): Limit should read **63430**. The configuration assignments of $b\,^3D$ and $b\,^2G$ should be interchanged.
85	Co III	Add reference: M. A. Catalán y R. Velasco, An. Real. Soc. Esp. [A] **48**, 247 (1952) (I P).
103	Ni III	Add references: M. A. Catalán y R. Velasco, An. Real. Soc. Esp. [A] **48**, 247 (1952) (I P). A. G. Shenstone, J. Opt. Soc. Am. **44**, 749 (1954) (I P) (T) (C L); Revised analysis. O. García-Riquelme, An. Real. Soc. Esp. [A] **51**, 59 (1955) (C L) (E D).
111	Cu I	Add reference: K. Murakawa, J. Phys. Soc. Japan **11**, No. 7, 774 (1956) (hfs).
121	Cu III	Add reference: M. A. Catalán y R. Velasco, An. Real. Soc. Esp. [A] **48**, 247 (1952) (I P).
124	Zn I	Add reference: W. R. S. Garton and A. Rajaratnam, Proc. Phys. Soc. London [A] **68**, 1107 (1955) (T) (C L): Suggests that the level at 80795 should have the designation $4p^2\,^3P_2$.
128	Zn III	Add reference: M. A. Catalán y R. Velasco, An. Real. Soc. Esp. [A] **48**, 247 (1952) (I P).
130	Ga I	Add reference: W. R. S. Garton, Proc. Phys. Soc. London [A] **65**, 268 (1952) (T) (C L).
133	Ga III	Add reference: M. A. Catalán y R. Velasco, An. Real. Soc. Esp. [A] **48**, 247 (1952) (I P).
135	Ge I	Add references: G. V. Deverall, K. W. Meissner, and G. J. Zissis, Phys. Rev. [2] **95**, 1463 (1954) (T) (C L); Precision measurements. R. D. Van Veld and K. W. Meissner, J. Opt. Soc. Am. **46**, 598 (1956) (T) (C L). K. L. Andrew and K. W. Meissner, J. Opt. Soc. Am. **47**, 850 (1957) (T) (C L): Report new term: $4s4p^3\,^5S^\circ_2$ *41926.726*.
144	As II	A. M. Crooker and R. E. Bedford, unpublished material (December 1955) (I P) (T) (C L); Revised analysis: Limit should read **150290**, I. P. 18.63.
146	As III	Add references: R. E. Bedford and A. M. Crooker, Phys. Rev. [2] **96**, 845 (A) (1954) (T); unpublished material (1955) (I P) (T): Limit should read ***228670***, I. P. 28.34.
147	As IV	Add reference: R. E. Bedford and A. M. Crooker, Phys. Rev. [2] **96**, 845 (A) (1954) (T).
156	Se V	Add reference: W. Finkelnburg und W. Humbach, Naturwiss. **42**, 35 (1955) (I P): From screening constants, interpolated I. P. is 68.3 ± 0.1.
159	Br I	J. L. Tech, unpublished material (July 1957) (T) (C L) (Z E): Reports new description and analysis of the spectrum being made at the National Bureau of Standards by J. L. Tech and C. H. Corliss.
163	Br III	Add reference: Y. B. Rao, Indian J. Phys. **30**, 371 (1956) (T).
164	Br IV	Add reference: W. Finkelnburg und W. Humbach, Naturwiss. **42**, 35 (1955) (I P): From screening constants, interpolated I. P. is 47.3.
165	Br V	Add reference: W. Finkelnburg und W. Humbach, Naturwiss. **42**, 35 (1955) (I P): From screening constants, interpolated I. P. is 59.7 ± 0.1.
166	Br VI	Add reference: W. Finkelnburg und W. Humbach, Naturwiss. **42**, 35 (1955) (I P): From screening constants, interpolated I. P. is 88.6 ± 0.2.
167	Br VII	Add reference: W. Finkelnburg und W. Humbach, Naturwiss. **42**, 35 (1955) (I P): From screening constants, interpolated I. P. is 103.0 ± 0.4.

Page	Spectrum	Remarks
169	Kr I	Add reference: C. J. Humphreys and E. Paul, Jr., U. S. Naval Ord. Lab., NAVORD Report 4600, 29 (1957) (T) (C L); Infrared observations. In 1952 ref., page no. 73 should be inserted. The level at 105989.60 should have the *J*-values 4,5.
184	Rb II	Add reference: H. Kopfermann, A. Steudel, und J. O. Trier, Zeit. Phys. **144,** 9 (1956) (hfs); Fine structure, corrections to analysis.
191	Sr II	The designations for the ^2G series should have n increased by 1, i. e. $n=5$ to 11.
196	Y I	Add references: M. A. Catalán y F. R. Rico, An. Real. Soc. Esp. [A] **48,** 328 (1952) (I P): Revised limit **51447**, I. P. 6.38. L. F. H. Bovey, Proc. Phys. Soc. London [A] **68,** 79 (1955) (C L); Infrared observations.
199	Y II	Add references: M. A. Catalán y F. R. Rico, An. Real. Soc. Esp. [A] **48,** 328 (1952) (I P): Revised limit **98690**, I. P. 12.23. L. F. H. Bovey, Proc. Phys. Soc. London [A] **68,** 79 (1955) (C L); Infrared observations.
201	Y III	Add reference: M. A. Catalán y F. R. Rico, An. Real. Soc. Esp. [A] **53,** 85 (1957) (I P): Revised limit **165500**, I. P. 20.51.
205	Zr I	Add reference: M. A. Catalán y F. R. Rico, An. Real. Soc. Esp. [A] **48,** 328 (1952) (I P): Revised limit **55145**, I. P. 6.84. The level $v\,^3G^\circ_3$ *36941.65* has Obs. $g=0.87$.
209	Zr II	Add references: C. C. Kiess, J. Opt. Soc. Am. **43,** 1024 (1953) (T) (C L); Extension of analysis from infrared observations; revises $4d^3\,d\,^2D$ to read: $d\,^2D$ 2½ 27640. 60 −59. 36 1½ 27699. 96 M. A. Catalán y F. R. Rico, letter (December 1956): revised limit should read **105900**, I. P. 13.13.
212	Zr III	Add references: C. C. Kiess, J. Research Nat. Bur. Std. **56,** 167, RP 2663 (1956) (I P) (T) (C L) (Z E); Revised analysis. M. A. Catalán y F. R. Rico, An. Real. Soc. Esp. [A] **53,** 85 (1957) (I P): Revised limit **185400**, I. P. 22.98.
213	Zr IV	Add reference: C. C. Kiess, J. Research Nat. Bur. Std. **56,** 167, RP 2663 (1956) (I P) (T) (C L) (G D); Revised analysis: Limit should read **276970**, I. P. 34.33.
214	Zr VI	C. C. Kiess in conversation (September 1955) has reported the analysis incorrect.
216	Nb I	Add reference: M. A. Catalán y F. R. Rico, An. Real. Soc. Esp. [A] **48,** 328 (1952) (I P): Revised limit **55511**, I. P. 6.88.
221	Nb II	Add reference: M. A. Catalán y F. R. Rico, letter (December 1956): Revised limit should read **115500**, I. P. 14.32.
223	Nb III	Add references: L. Iglesias, An. Real. Soc. Esp. [A] **50,** 135 (1954) (T) (C L); Analysis extended from ultraviolet observations. L. Iglesias, J. Opt. Soc. Am. **45**, 856 (1955) (I P) (T) (C L); Revised analysis. M. A. Catalán y F. R. Rico, An. Real. Soc. Esp. [A] **53,** 85 (1957) (I P): Revised limit **202000**, I. P. 25.04.
XVIII	Ni I sequence	For configurations having F-limit terms, under "*nf*" add S° and P° as predicted terms; for those having G-limit terms, add P° and D° as predicted terms. Similarly, under "*ng*", for F-limit terms, add P and D as predicted terms; and for those having G-limit terms, add S, P, D, F as predicted terms.

Note Added in Proof

130	Ga I	B. Edlén (letter, February 1958) states that the n-values for $nf\,^2F^\circ$ terms should be increased as follows: 4 to 5, 5 to 7; 6 to 8; 7 to 9. The terms $4f\,^2F^\circ$ and $6f\,^2F^\circ$ are still missing.
202	Y V	B. Edlén (letter, March 1958) reports the analysis incorrect.

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