The book is reproduced directly from typewritten copy and, as a result, both the clarity and ease of reading suffer considerably. Subscripts and superscripts are in the same size type as the body of the text, resulting in a cluttered, crowded appearance. Furthermore, the references are given as superscripts in the identical manner as are the isotopic masses. The quality of paper and binding appear adequate.

As is usual in a collection of this kind, there is considerable variation in style among the different authors. The differences are unnecessarily intensified by use of differing formats and conventions by each author. Some use letters, some numbers, some both, and some no numbers at all to identify a particular synthesis. Different systems of denoting the isotopic labeling also are used. The book certainly would have been improved by more vigorous editorial direction.

The initial chapter entitled General Procedures is so brief and simplified that it is almost useless and could well have been replaced by a list of well chosen references. The chapter on deuterium labeling is very specific with complete directions for a great number of syntheses. However, a number of the descriptions are rather long and over-complicated (*i.e.*, p. 20, the synthesis of LiD, where $1^1/_2$ pages describe the preparation of D_2 from D_2O and $^1/_4$ page the actual synthesis of LiD), and frequently no evaluation of competing methods is made. The preparation of compounds containing tritium is more succinctly yet adequately described in Chapter 3 but suffers from failure to recommend the more desirable methods. Chapter 4 on the use of N^{15} is extremely verbose, far beyond the needs of any reasonably well trained chemist. This chapter also contains a large number of typographical errors. The introduction of O^{18} into compounds is lucidly described in Chapter 5 with a recommended method described for each synthesis and literature references to other methods. The longest chapter is the one entitled Radiophosphorus. It would have been much better if only one-half as long. On pages 161–165, for example, six methods for preparing PCl_3 are given in detail and then only two are recommended for use. Each synthesis is assigned a number and then a different number in brackets is assigned to the particular equation pertinent to the synthesis. Then reference to that synthesis in the text is made by a bracketed number following a formula, the bracketed number referring to the equation number and not to the bold face synthesis number. This needlessly complicated system took the reviewer some time to unravel.

The final three chapters on sulfur, chlorine, and iodine present the syntheses in an orderly and efficient way without going into excessive detail and seem to be at least as useful as the very long chapters.

The index is by subject only and appears to be adequate in its coverage.

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Advanced Inorganic Chemistry. By F. A. COTTON and G. WILKINSON. Interscience Publishers, John Wiley and Sons, Inc., 440 Park Avenue South, New York 16, N. Y., 1962. xv + 959 pp. 23.5 × 16 cm. Price, $14.50.

This is an excellent and modern text, suitable for a senior or beginning graduate course in inorganic chemistry. The organization is, briefly, as follows. An 85-page introduction reviews general electronic theory of atoms and chemical bonding. The approach, while mathematically restrained, does make fluent use of simple wave mechanical formulations in a way calculated to convince a student that the subject is perhaps not so difficult after all. Then follows some 400 pages of fairly standard coverage of the chemistry of non-transition elements. The emphasis is more on structural and bonding considerations than on either preparative chemistry or chemical kinetics, but in general a fair balance is maintained. From time to time simple molecular orbital diagrams are given along with the older line-bond representations.

The final section of the book falls into two parts. The first comprises a survey of transition metal chemistry, mainly that of Werner type complexes, and mainly from a constitutional point of view, followed by a somewhat sketchy, although authoritative, presentation of crystal and ligand field theory. The remaining, and longer part consists of about 300 pages of detailed description of first row transition elements and of the lathanide and actinide series. There is a short appendix and a shorter index.

It is no disparagement to say that the book by no means exhausts inorganic chemistry; no one volume could. It follows that while the book should be fairly useful to the practicing chemist, inorganic or otherwise, it should function best as a textbook for presenting the subject in a modern light to students. While there are no detailed literature references, suggestions for collateral reading are provided. While these are somewhat erratic in ranging from broad reference collections to highly specific articles, they do reflect the intimate acquaintance of the authors with an amazing breadth of inorganic chemistry. From a textbook point of view, however, it is to be regretted that no problems or study questions are provided.

There are a fair number of errors, omissions, and other nondesiderata. While on p. 56, resonance structures are carefully described as having no real existence, elsewhere, as on pp. 58–61 and p. 69, the authors fall into the practice of talking about resonance structures as though they were separately existing ingredients of a chemical bonding situation. It has been noticed that the figures on p. 17 of balloon representations of p-orbitals are confusing. They are signed plus and minus, corresponding to angular wave function plots, yet are oval rather than round, so must actually be the squares of the function; they reach to the origin, yet in the text are described as 90% contours. Also, the figure depicting atomic orbital energies (p. 496) seems unnecessarily confusing. Representative errors or misprints noticed include a sign omission in eq. (2–5), an upside down figure on p. 48, ΔF instead of ΔF° on p. 138, a formula error on p. 531, an inversion of the ^4D and ^4P levels in the diagram on p. 702, and a fair scattering of misprint-type spelling errors. There is noticeable variation in style, indicating the writing to be truly coöperative. Finally, it is unfortunate the publication date allowed the statement on p. 145 that rare gases form no compounds.

The above and other items will presumably be corrected in the further printings this book undoubtedly will enjoy. Over-all, it is indeed a pleasure to welcome it with much appreciation to the authors for their excellent job.

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Argon, Helium, and the Rare Gases. Volumes I and II. Edited by GERHARD A. COOK, Research Laboratory, Linde Co., Tonawanda, N. Y. John Wiley and Sons, Inc., Interscience Division, 440 Park Avenue South, New York 16, N. Y., 1961. xxvii + 818 pp. 15.5 × 23.5 cm. Price, $17.50 per volume.

Theoreticians have long suffered the frustration of finding scanty and scattered data on the inert gases, which are ideal substances for verifying theories of the structure of matter. A monograph on the group 0 elements should indeed be welcomed. Cook and his collaborators set themselves the task of critically reviewing the state of knowledge of the inert gases, assessing the validity of various conflicting measurements and experiments, and finally reporting the "best" values of properties and behavior. The end result is extremely useful and should stand for a number of years as the basic reference on the subject. Fifteen authors have collaborated to produce 20 chapters distributed through two volumes of approximately 800 pages. The

editor and eight of the authors are from the Linde Company Laboratories. Their contributions have been supplemented by those from workers in university and government laboratories and the publishing business. The backgrounds of these individuals include physical chemistry, physics, technical librarianship, nuclear engineering, chemical engineering, biochemistry, business administration, and petroleum engineering. In addition to discussions of fundamental properties, the books include such diverse topics as physiological effects, applications to arc welding, and illuminated signs. With the possible exception of an occasional reviewer, it is unlikely that anyone will undertake to read the entire two volumes since there are a number of unrelated topics. As a corollary to the previous statement, it should be apparent that it is unlikely that any single reviewer, and certainly not the present one, could comment on the entire book with uniform authority.

Volume I will perhaps be of most use to physical chemists and physicists. It contains chapters on the history, occurrence and origin, and nuclear structure. Although the book was written before the discovery of the xenon and krypton fluorides, there is an interesting chapter on ion chemistry, clathrates, and mixed crystals. A chapter on atomic structure and spectra contains a large number of useful energy-level diagrams and extensive tables of energy levels, polarizabilities, oscillator strengths, etc.

There are two chapters on gas phase properties, one concerned primarily with transport phenomena, the second with volumetric and thermodynamic behavior. There is a long chapter on liquid and solid state properties and a final chapter summarizing physical properties. In all four of these latter chapters the authors have done a good job of surveying the literature and selecting the most likely values for properties. These results are reported in carefully prepared tables and figures. Volume II contains much more technology, although the chapters on phase equilibria, analytical determinations, and physiological effects will be found in this section.

These two volumes are lengthy and expensive, and therefore one has to question the wisdom of the inclusion in the chapter on atomic structure of approximately 23 pages of introductory discussion of spectra and quantum chemistry in general. There is an equally luxurious 3-page exposition on general thermodynamics of the critical region in the chapter on thermodynamic properties of the gas phase. The chapter on cryogenic applications appears to be primarily qualitative discussions of information which appeared in previous chapters on liquid or gaseous state properties, or which could be found in standard references on experimental low-temperature physics. In these instances and several others, the book could have been shortened and made more readable by reference to standard works and by somewhat more ruthless editing.

The editor asserts in the preface that special effort has been made to give all units and conditions clearly, an objective which has been generally attained. However, in the chapter on liquid and solid state properties, units are repeatedly denoted in footnotes to the tables, with powers of 10 attached to the units in such a manner that the reader has to ponder whether the tabulated value is to be, or already has been, multiplied by the indicated power of 10. In both Fig. 1 and Table XXIX of Chapter VII, units are not stated for the diffusion coefficient, although one infers that they are cm.^{2}/sec.

There are some errors and points of ambiguity. On pages 252, 253, 306, and 307 there is inadequate distinction made between the coefficients of the virial equation of state for a gas and the coefficients of empirical equation of state; the unwary reader could easily infer erroneously that empirical equation of state coefficients could be "——expressed in terms of intermolecular potential functions by means of statistical mechanics." On page 319 an incorrect formula is given relating the interatomic distance to the characteristic lattice constant for the face-centered cubic lattice. On the same page the assertion is made that at, 0°K., the interatomic distance in the lattice is expected to be equal to the distance of minimum energy in the intermolecular potential function, thus ignoring all interactions except with nearest neighbors. On page 365, in a discussion of the isothermal compressibilities of the solid inert gases, the following statements appear: "The values at zero pressure in Table XI are about 10 times larger than similar values for other substances (*e.g.*, K_T is about 30×10^{-11} cm.^{2} dyne^{-1} for sodium chloride). The great compressibility of the inert elements is a consequence of the weakness of the van der Waals forces between the atoms." This is really a curious mixture of confusion: a number of substances, for example, rubidium and cesium, have isothermal compressibilities comparable to those of the inert gases; the given value of K_T for sodium chloride is incorrect and, as a matter of fact, as stated negates the claim of the sentence; the second sentence is certainly incorrect if it implies that the van der Waals forces between the inert gases are weaker than van der Waals forces between most other atoms, although, of course, van der Waals forces in general are many orders of magnitude less than the ionic forces acting in a substance such as sodium chloride. On page 373, in a discussion of the structure and radial distribution function of liquids, there appears the statement, "The X-ray and neutron experiments agree quite well with each other." This is simply not the case, at least for liquid argon.

One of the very useful features of the book is Table I of Chapter X, which is a summary of the physical properties of the inert gases. However, this might be approached with some caution. It was found on cursory examination that the tabulated value for the viscosity of liquid argon is in error by a factor of 1000, and that the reported value for the thermal conductivity of liquid helium appears to disagree somewhat from the best value reported in the preceding chapter on liquid state properties.

There are unfortunate omissions of work on physical properties. The authors include no values for the coefficient of thermal expansion or for Poisson's ratio for solid argon, although both are available in the literature. Interesting studies of the heat capacity of fluid argon by Jones and Walker and measurements of sound absorption of xenon near the critical state by Schneider are not mentioned. The chapter on phase equilibria seems superficially done compared to the previous chapters on properties.

In spite of some shortcomings and the indicated errors, these two volumes still constitute a worthwhile work. However, a reader interested in the properties of the rare gases would be well advised to not to forsake Din, Hilsenrath, Rowlinson, and the classic review paper by Dobbs and Jones. Cook's volumes should stimulate further work on the inert gases. One hopes, in turn, that the editor and authors might, at an early date, prepare a revised edition, hopefully somewhat more critically written and more tersely edited.

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February 1–April 1, 1963

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