$C_{26}H_{23}NO$ and $C_{28}H_{16}$. An immense amount of labor must have been involved in combing the almost 1000 references that are cited. Because diamagnetism is usually almost independent of temperature, the measurements that are recorded are usually made at room temperatures; so each compound as a rule occupies a few lines at most, in contrast to the elaborate thermal data in the earlier book (which sometimes required a whole page for a particular ferromagnetic compound). As a result there is practically no commentary, and it is immaterial that the text is in English. No comparison is made with theory, although the calculation of the inert-gas diamagnetic susceptibilities furnishes one of the best tests of atomic wave functions.

27 pages are devoted to diamagnetic anisotropy. This requires more detail than the rest of the volume, as the experiments that are documented are more difficult and the directions of the principal axes must be specified.

The book closes with five pages of data on organic paramagnetic molecules. The data presentation would be clearer if it explicitly said that the molecule is either even or odd (thereby saving the reader some simple arithmetic) and if the "spin-only" value for odd molecules were listed on each page for comparison. Even molecules are generally only feebly magnetic, and so often times the experimenters simply report a susceptibility "greater than zero." The common paramagnetic gases O_2, NO and NO_2 are not included, as they are inorganic. Their susceptibilities were not covered in the earlier book either. The resulting omission from the generally very thorough Landolt–Börnstein tables is a curious one, for it was the study of oxygen that led Pierre Curie to formulate his famous law.

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J. H. Van Vleck, Hollis Professor of Mathematics and Natural Philosophy at Harvard University, is best known for his work in magnetism.

Magnetochemistry

ELECTRON PARAMAGNETISM. By Juan A. McMillan. 226 pp. Reinhold, New York, 1968. $14.50

by H. HOLLIS WICKMAN

This volume was written primarily for chemists, and as a text is intended for the advanced undergraduate. The author is former chairman of the chemistry department at the University of Cuyo at Bariloche, Argentina, and is in the solid-state division of Argonne National Laboratory. The contents include the basic information necessary for an appreciation of paramagnetism and crystal-field effects in solids. Generally the topics are restricted to ground-state paramagnetism of ions or free radicals. There are no exercises.

A short review of classical magnetism and atomic physics is provided in early chapters, but this is no substitute for a previous course in modern physics, which would be a prerequisite for this text. The treatment of magnetic susceptibilities and their measurement is generally complete, and representative examples of typical paramagnetic species are discussed. A section on symmetry and groups contains most of the useful finite-group-theoretical terminology appropriate to the level of the book; this chapter forms a basis for later development of ideas relating to crystal fields. The thermodynamics of magnetism is covered in a separate chapter, but this seems to stand somewhat apart from the main emphasis of the volume. The remainder of the book is devoted to electron paramagnetic resonance, with special emphasis on spin Hamiltonians representing magnetic anisotropy, hyperfine interactions and crystal fields. The discussion of these points is primarily descriptive and nonrigorous, but certainly would provide the reader with a feeling for the basic parameters characterizing a typical electron-paramagnetic-resonance spectrum. Examples of spectra are provided to illustrate the topics in the text, and a brief description of the experimental details involved in epr work is given.

The range of topics covered is rather broad, and not all subjects are given equally complete treatment. The discussions may therefore not always be sufficiently detailed for the more serious student or reader. However, references (through 1965) are provided at chapter endings, and these lead to more complete treatments. There are occasions in the book at which conventions and illustrations adopted by the author differ from general usage enough to be potentially disconcerting to the reader. These range from minor points such as use of luthecium for lutetium and term symbols $^2D_{1 1/2}$ and $^2D_{2 1/2}$ for $^2D_{3/2}$ and $^2D_{5/2}$, to decisions on emphasis in introducing a topic. In the second category, paramagnetic resonance is introduced without consideration of the resonance condition in the rotating frame; the Bloch equations are mentioned but do not explicitly appear. Also, the condition given for averaging anisotropic hyperfine interactions in the epr spectrum is a sufficient condition, but not the usual necessary condition; consequently the discussion would not readily apply to the case of spin labeling, which is currently of interest to chemists.

In summary, the usefulness of the book will depend largely on the depth with which the reader wishes to pursue paramagnetism and epr. The book would probably not appeal to physics students, especially those with a modern microscopic introduction to magnetic phenomena. It should serve its intended purpose of providing an introduction to several topics in magnetochemistry that may not generally be found in undergraduate chemistry courses.

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Review of nonmetallic compounds

EXPERIMENTAL MAGNETOCHEMISTRY: NONMETALLIC MAGNETIC MATERIALS, VOL. 8. By Michael M. Schieber. 572 pp. Wiley, New York, 1967.

by WERNER WOLF

The study of magnetic materials has been undergoing a remarkable development during the past 20 years. Starting from the esoteric and rather specialized work of just a few laboratories, it now constitutes one of the largest branches of solid-state physics, and it has been estimated that publications in magnetism currently amount to more than 2000 papers per year. Many of these deal with the preparation and properties of new magnetic materials, and it is clear that up-to-date reviews are badly needed by workers in the field. The present volume attempts to give such a review for the large class of nonmetallic compounds.

Given the enormous amount of pub-

lished material, the author is faced with a major problem of selection and coherent presentation, and in particular he has to decide whether to discuss in detail a few illustrative examples and principles, or whether to attempt a more comprehensive, if thereby more superficial, review. The present volume clearly falls into the latter category.

The author, Michael M. Schieber, well known for his many activities in the crystal-growing community, in the relatively brief space of 500 pages, strives to review the properties of nearly as many magnetic compounds; he includes almost 200 figures (most reproduced without change from the original papers) and over 100 tables summarizing results. There are references to more than 1000 papers and separate indexes for individual authors, subject matter and chemical formulas. The main body of the book therefore has some of the character of a section of the Landolt-Börnstein tables, but with connecting passages of text that aim to put the many facts into perspective. Even so, there is little coherence, and each topic tends to get treated on an individual basis.

Three introductory chapters summarize the basic principles of theoretical magnetism, methods of preparing various types of materials and techniques for characterizing their magnetic properties. Such a discussion may be useful to some readers, but many will find it either too brief or too long. For the active research worker in the field much of it will be redundant, whereas for the reader really unfamiliar with this basic material, a considerable amount of additional reading will be required.

The main part of the book, which discusses the magnetic and crystallographic properties of specific materials, is divided into chapters on: iron oxides and their compounds, oxides of other transition metals, rare-earth oxides, and other compounds of transition and rare-earth elements. Each of these chapters is further divided and subdivided into many shorter sections; these sections; with reference labels such as 6:4.4.5, are used for all indexing and cross-referencing purposes. This procedure is clearly the simplest for the author, but from the point of view of the reader a translation into page numbers would be very much more convenient.

This seemingly trivial feature is unfortunately characteristic of other aspects of this book. One frequently gets the impression of being presented with material that simply happened to be close to the author's hand at the time he was assembling the manuscript; one can not help wishing that more care had been taken in sifting and checking the vast amount of information that is being presented. In this connection we may cite specifically references to unpublished reports that have since appeared in print, the inclusion of various sections of peripheral relevance especially in the introduction and appendixes, fundamental constants quoted to different and sometimes incorrect numbers of significant figures, as well as numerous misprints and misquotations.

These aspects tend to undermine one's confidence and pleasure in what is otherwise a most welcome book. Even so the author must be commended for his fearless attempt to present a huge and rapidly moving subject in a form that should prove to be a stimulating reference source.

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Slater emphasizes physics

QUANTUM THEORY OF MOLECULES AND SOLIDS, VOL. 3: INSULATORS, SEMICONDUCTORS, AND METALS. By John C. Slater. 549 pp. McGraw-Hill, New York, 1967. $12.50

by N. D. MERMIN

Although this is volume 3 in a series (following *Electronic Structure of Molecules* and *Symmetry and Energy Bands in Crystals*), its approach is in large part elementary, and the author, John Slater, suggests that it is most suitable as an elementary text in solid-state theory. The book does rely on its predecessors in assuming some background in Bloch waves and energy-band theory, and in drawing occasional examples and analogies from the theory of molecular electronic structure, but otherwise the book is quite independent of volumes 1 and 2.

On the other hand a formidable arsenal of earlier Slater books is freely invoked, sometimes to supply missing steps (the Sommerfeld expansion of the low-temperature Fermi distribution) and sometimes to fill in whole areas (the Debye theory of specific heats). The book is thus complete in some discussions and sketchy elsewhere, and its level curiously uneven: A reader assumed to be so at home in the zone that he knows his X's from his L's without a diagram, must still be told that Coulomb's law implies Poisson's equation.

However, there is no really good solid-state text and probably never will be. The pertinent question to ask of each new attempt is: On what few aspects of the subject can it serve as an effective reference or introduction? The outstanding features of Slater's book are his persistent determination to replace mathematical analysis by physical reasoning and his historical view of the material as he traces each topic from its prequantum origins.

This approach, providing entertaining and informative discussions with an absolute minimum of mathematical obstacles, is most successful in broad discussions of the Drude–Lorentz theories of optical properties of metals and insulators, the classical theory of x-ray diffraction and the Madelung–Ewald theory of lattice energies. These subjects make up about half the text.

Elsewhere one finds some shorter discussions on the same gratifying level (impurity levels and cylotron resonance in semiconductors) mixed with treatments that are sketchy (most aspects of lattice vibrations do not bear directly on x-ray scattering or dielectric properties) or even dangerously misleading (nothing is said to dispel an impression that the Hall constant is field independent; it is stated that the extraction of Fermi statistics and a one-electron picture from the full many-body theory is a "serious gap in the logical foundation of the theory," even though many of the basic papers on Fermi-liquid theory can be found in the bibliography).

The net result is a highly personal, entertaining, frequently illuminating, sometimes maddening view of some topics in the phenomenological theory of solids. More than any book on this level that I can think of, it can be read like a novel.

There is also a bibliography. The text ends on page 279, the appendixes on page 350, and the remaining almost 200 pages contain an immense list of references (giving titles as well —a most commendable practice). The author's primary concern is with trans-