suffers most noticeably from a lack of descriptive material. The uninformed reader will be little impressed by the utility and power of the ligand field theory without specific illustrations of some of the many well established examples of the use of the theory in predicting and correlating electronic properties and structures.

In this time of rapidly multiplying knowledge, a current text in nearly any field will be equally distinguished by what it omits as by what it includes. The authors state in the preface that "we have treated those [topics] which seemed to us most relevant to the modern inorganic chemists," and acknowledge that "there will be disagreement concerning the emphasis placed on various topics as well as the omission of others." The reviewer strongly concurs with the latter statement and feels that the most serious deficiency of this otherwise essentially sound text lies in the choice of some topics and the complete omission of others. Amongst those topics which could be considered "theoretical" in the sense of this book, no mention whatever is made of bonding and structure in electron deficient compounds or in organometallics—metal cyclopentadienyl, arene and olefin complexes. Further, there is no discussion of the use of physical methods, such as nuclear and electron resonance and infrared spectroscopy, in establishing structures and elucidating chemical bonding. Included are chapters on acids and bases, electromotive force, and non-aqueous solvents which, while capably presented, are perhaps best placed in a source bearing a different title. The chapter on the theory of the nucleus appears too brief and introductory compared to other textual sources to be very useful, and a subject development of the type attempted here (including α and β decay theories) seems out of place in a chemistry text, however theoretical. These views are admittedly personal ones and undoubtedly some readers will find the choice of topics completely satisfactory.

On the whole the book is quite clearly written and the subject matter rather well developed. It is a welcome change from nearly all current inorganic texts which too often consist of encyclopedic recitations of chemical facts with little attempt to interweave principles. Development of topical subjects from a mathematical or semi-quantitative quantum mechanical point of view is long overdue in an inorganic text and this book represents a healthy stride in that direction.

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Determination of Organic Structures by Physical Methods. Volume 2. BY F. C. NACHOD, Sterling-Winthrop Research Institute, Rensselaer, New York, and W. D. PHILLIPS, Central Research Department, E. I. du Pont de Nemours and Co., Wilmington, Delaware. Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1962. xiii + 771 pp. 16 × 23.5 cm. Price, $16.00.

The second volume of the "Determination of Organic Structures by Physical Methods" devotes nearly half its pages to resonance spectroscopy, in an expansion of this subject consistent with the major advances of the period since 1955, when the first volume was published. The well-referenced chapter on Optical Rotatory Dispersion, covering 92 pages and the research contributions of the last seven years, provides a striking contrast to the two-page mention of this subject in the first volume. The examples of rotatory dispersion are prudently selected and the principles clearly stated; moreover, the number of curves has been kept to a useful minimum. The chapter on Mass Spectrometry is fairly comprehensive. It presents the general possibilities and difficulties of using mass spectrometers for structure determination, along with a qualitative view of what goes on inside the instrument and inside a molecule which has been hit by an electron. The sections on rearrangements, functional group effects and special techniques provide information sufficient to excite the imagination. One can easily foresee that this subject will be greatly expanded in a third volume of the series.

Infrared and Raman Spectroscopy are combined in a chapter concentrating on the theoretical background of vibrational spectra and introducing the subject of absolute intensities. The treatment of Electronic Spectra of Polyatomic Molecules and the Configurations of Molecules in Excited Electronic States is highly theoretical. It will stimulate those who seek information concerning the geometry of excited states but will completely satisfy only those who are willing to classify ethylene among the "larger molecules." The chapter entitled Far and Vacuum Ultraviolet Spectroscopy may be regarded in part as a continuation of the chapter on Ultraviolet and Visible Light Absorption in Volume I. Ionization potentials are tabulated for aliphatic, alicylic, unsaturated and aromatic hydrocarbons. Solution spectra run under special conditions and data culled from technical reports and private communications as well as the normal journal references have been used to assemble the N → V transitions in olefins, the absorption maxima of aromatic compounds in the region 1720–2000 Å., and the short wave-length maxima for ketones, amides and imides.

The second portion of the volume is devoted to resonance spectroscopy, starting with a chapter on High Resolution H^1 and F^{19} Magnetic Resonance Spectra of Organic Molecules which is a good review of theory and types of applications. It moves too fast to be considered as an introduction for a reader not familiar with quantum mechanics and it is not a guide for empirical application of n.m.r., but it is complementary to the excellent books on the subject. Particular attention is paid to applications of n.m.r. in kinetic studies of fast reactions including isomeric and conformational equilibration. The review on Nuclear Magnetic Resonance Spectra of Elements Other than Hydrogen and Fluorine serves to inform the reader of the progress which has been made in a very valuable but, in many cases, experimentally more difficult form of n.m.r. Chemical shift tables are included for C^{13}, B^{11}, N^{14}, O^{17}, Si^{29}, P^{31}, Sn^{119} and other nuclei, which give an indication of the value of the technique in analysis and in structure determination. The brief treatment of Nuclear Magnetic Resonance Spectra of Organic Solids shows how the F^{19} and H^1 spectra can be used to determine structure in a limited number of cases and to derive information concerning free or hindered molecular motion.

The contributor of the Chapter on Electron Paramagnetic Resonance of Organic Molecules gives a lucid introduction to the qualitative theory of e.p.r. and illustrates the theoretical considerations with a review of selected problems in which e.p.r. spectroscopy has produced evidence concerning structure and bonding in organic free radicals. The chapter on Electron Paramagnetic Resonance of the Organometallics is more mathematical and perhaps of less general interest. The final chapter provides a satisfactory coverage of Nuclear Quadrupole Resonance Spectroscopy.

In criticism of the book as a whole, this reviewer finds that the individual chapters are aimed at different kinds of readers, so that it becomes more a collection of monographs. The experts who have contributed these monographs are: Gloria G. and Robert E. Lyle, F. W. McLafferty, M. Kent Wilson, D. A. Ramsay, D. W. Turner, W. D. Phillips, Paul C. Lauterbur, R. E. Richards, Richard Bersohn, Richard E. Robertson and Chester T. O'Konski.

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Cours de Cristallographie. Livre III. Première Partie. **Radiocristallographie Théorique.** Deuxième Partie. **Methodes de Cristal Tournant. Determination des Structures Cristallines.** Troisième Partie. **Methodes de Poudres.** By R. GAY, Professeur à la Faculté des Sciences de Bordeaux. Gauthiers-Villars et Cie., 55, Quai des Grands-Augustins, Paris 6, France. 1961. 278 pp. 16 × 25 cm. Price, 38 NF.

This is the third of a series of three volumes giving an account of a course in crystallography taught by the author. The first two volumes, on geometrical crystallography and physicochemical crystallography, provide the background for the volume under review; but the latter is easily readable by those familiar, from other sources, with the material contained in the first two volumes.

The third volume is divided into three parts. The first part treats of two subjects. In the first two chapters a very brief but readable account is given of the nature of X-rays and the means by which they are produced. The remaining eight chapters of the first part are concerned with those aspects of Fraunhofer diffraction which are related to crystal problems. The author bases his treatment entirely on Fourier transforms, of which he exhibits a wide understanding. Although he assumes that his reader knows what such a transform is, he gives enough illustrated examples to give a reality to the technique that is unusual in the more formal treatments; and it would be possible for a reader who knew little or nothing of Fourier transforms to learn about them here. The first part ends with a statement of the fundamental problem of diffraction analysis: the determination of the phases of the scattered beams whose intensities have been measured.

The second part is concerned with the determination of structures. In this part, the first chapter is a very brief account of some photographic methods for the measurement of X-ray diffraction intensities. The second chapter is concerned with the calculation of the Patterson function, the third with the determination of the space group, and the fourth with the problem of determination of the structure. This part of the book gives an account of the whole progress of an X-ray investigation which is very clear and should be understandable to a reader outside the field who has the necessary mathematical background. For one who plans to work in the field it provides a connected introduction on which to hang additional reading.

The third and shortest part is concerned with powder, liquid and fiber diagrams and the study of texture by these methods.

This text is an example of the clarity of language and presentation for which the French are noted and which makes its reading so pleasant and informative. The planning of the course is worthy of a real study by anyone who has the duty of teaching X-ray crystallography, and this and the earlier volumes are recommended for students of crystallography who have or need facility in French.

The book is produced in photo-offset from justified typescript and is an excellent example of this technique even as far as the X-ray photographs are concerned.

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Landolt-Börnstein. Zahlenwerte und Funktionen aus Physik, Chemie, Astronomie, Geophysik, und Technik. Sechste Auflage. Zweiter Band. Eigenschaften der Materie in Ihren Aggregatzuständen. 4. Teil. Kalorische Zustandsgrössen. Edited by KLAUS SCHÄFER and ELLEN LAX. Springer-Verlag, Heidelberger Platz 3, Berlin-Wilmersdorf, Germany. 1961. xii + 863 pp. 20.5 × 27.5 cm. Price, DM. 438.--.

This book contains values of the thermodynamic properties of the elements, compounds, and alloys, as well as heats of reaction for the formation of compounds from the elements and the change in heat content accompanying some other important reactions, such as the heat of neutralization of acids with bases and the heat of wetting of solid surfaces with liquids. The values are given generally in terms of joules per mole, except in a few cases where values in calories are also given. References are given to the original papers in the literature as well as references to prior compilations, though in general the two kinds of sources are not distinguished.

Covered in this book are the following: experimental and theoretical basic values for heats of combustion of organic compounds, by H. Kienitz; standard values at 25° for elements, inorganic compounds and organic compounds, for the heat capacity, entropy, heat of formation, and free energy of formation, for the change in heat content and heat capacity for changes of state, as transition, fusion, and vaporization, by W. Auer; values of the thermodynamic functions at standard pressure as a function of temperature, from low to high temperatures, for the elements and selected inorganic and organic compounds, by Kl. Schäfer and W. Auer; heat capacity as a function of temperature, from low to high temperatures, for the elements and inorganic and organic compounds, by W. Auer; heat capacity of gases as a function of pressure, by H. D. Baehr; heat capacity of gases in the plasma state, to 30,000°K., by F. Burhorn and R. Weinecke; values of the Planck–Einstein function and of the Debye function for thermodynamic functions, by Fr. Losch; values for anharmonicity and for free and restricted internal rotation, by Kl. Schafer; values for the Joule-Thomson effect and the isothermal Drossel effect, by H. D. Baehr; magneto-thermodynamic effect for paramagnetic salts at low temperatures, in tabular and graphical form, by H. Nelkowski; thermodynamic functions for metallic solutions, by O. Kubaschewski; heats of adsorption and wetting, by K. Bratzler; and heats of neutralization, by A. Neckel.

Prof. Dr. Klaus Schäfer and his associates are to be complimented on an excellent job. While significant advances have already occurred, it is hoped that in the years to come more international uniformity will prevail in the details of the presentation of material of this kind, including symbols, values of the fundamental constants, units of energy, etc. Every research library in science and engineering will need to have ready access to this book.

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Biochemical Applications of Gas Chromatography. By H. P. BURCHFIELD, Southwest Research Institute, San Antonio, Texas, and ELEANOR E. STOORS, Boyce Thompson Institute, Yonkers, New York. Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1962. xviii + 680 pp. 16.5 × 23.5 cm. Price, $22.00.

Gas chromatography, like other "chromatographic" techniques, is a device to resolve mixtures of compounds that are otherwise difficult to separate. It has accumulated already more than its due share of jargon. While the authors explain this by their repeated definitions, they do little to discourage it. If one consults a popular Oxford dictionary, one reads that "chromatography" is the "description of (or by) colors." The term chromatography was not unsuitable when applied to the visible separations of leaf pigments by Tswett on a solid column, and at least it had some justification in the early separation of protein amino acids on paper, for this operation was followed by the visible detection of the amino acids with ninhydrin. However, the term has lost all significance in its application to the separation of a mixture by what is known as "gas chromatography." It is too late to reverse the march of events and to devise a more rational nomenclature, but one hopes that this most valuable field of work is not to be as cluttered by uncritical applications as it is by unjustifiable or unclear jargon. If the simple operation long known as dialysis were to be rediscovered today, one trembles to think what the nomenclature might be.

In a necessary and systematic listing of terms, one reads (page 9) that "A *chromatogram* is a plot of the detector response *versus* time or volume of carrier gas. Idealized chromatograms obtained with differential and integral detectors for one component are shown in Figure 3." Or, again, "A *peak* is the portion of the chromatogram recording the detector response [differential type] while a single component emerges from the columns [if separation of a mixed sample is incomplete, two or more components may appear as one peak]." This sort of thing, whether quoted from other sources or not, proceeds through innumerable definitions and descriptions of phases of the technique. One wonders whether those who approach the problem without prior knowledge of the subject will find it easy to interpret this sort of writing. And when under Essential Oils one reads about "gas chromatography" of whole plant families, described as "chromatography of Myricaceae," "chromatography of Rosaceae (rose oils)," "chromatography of Labiatiae," etc., one wonders whether all traces of sensitivity to the precise use of words has disappeared. If botanists use the book, some will shudder to see whole plant families apparently characterized by one sample separation of one class of compounds, from one or even a few species. While some may justify this sort of thing by expediency and a plea that everybody knows what the authors mean, is it too much to ask that the words that are to convey this meaning should be appropriate? Perhaps, however, the "chromatography" is not any more precise than the words which describe it, for one gets the impression that the unwary may place implicit faith in the deceptively precise peaks on the line tracings that appear on the gas "chromatograms." In this, as in all other cases of chromatography of complex mixtures, a peak may often cover up more than one com-