

form a photohydrate. Finally, although the 270-nm peak in the excitation spectrum of APT-NBD is slightly red shifted from the corresponding peak in the absorption spectrum, the shift is quite small and probably experimental variation. Furthermore, the enol excited state is ruled out as responsible for fluorescence sensitization in our compounds by the high efficiency of such sensitization.

Thus the excited keto form of uracil and thymine is probably the precursor for both photohydration and fluorescence sensitization, and we really have no dependable information about the lifetime of this excited state.

Our data are sufficient, however, to allow us to state that the pyrimidine excited donor state concerned with energy transfer in APU-NBD and APT-NBD, etc., is a singlet excited state, not a "hot ground state" (since singlet excited states of the fluors are produced) and is not a triplet state of the pyrimidine, since NBD fluorescence in APT-NBD could not be sensitized by acetone, a known triplet donor.

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## References and Notes

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## Book Reviews\*

**Aromatic and Heteroaromatic Chemistry. Volume 2.** Edited by C. W. BIRD and G. W. H. CHEESEMAN. The Chemical Society, London, 1974. xvi + 519 pp. £16.00.

This volume of the Specialist Periodical Reports, according to the Editors, is based on the literature reported in Volumes 77 and 78 of *Chemical Abstracts*. The arrangement is as in Volume 1, in 15 chapters with titles largely corresponding to reaction types rather than structure; typical chapter titles are "Condensation Reactions," "Ring Interconversions," "Nucleophilic Substitution." The introductory chapter, "Ring Systems of Topical Interest," is an absorbing account of recent work with unusual or specially significant features. The contributors of the several chapters deserve much appreciation for their valuable efforts in producing a volume of both reference and recent-awareness value.

**Raman/IR Atlas.** Edited by B. SCHRADER and W. MEIER. Verlag Chemie, Weinheim/Bergstr. 1974. Vol. I: xxxi + ca. 330 pp. DM 230 (sold only in complete set of three volumes, DM 690 by subscription, or DM 795 after appearance of Vol. II).

This work reproduces on each page the infrared and the Raman spectrum of a specific compound, using a common scale linear in wave number. The pages are arranged in an order corresponding to structural features, beginning with saturated hydrocarbons, and eventually reaching organometallics, biopolymers, and inorganic compounds of interest to organic chemists. A prologue in English and German explains the organization, the origin and accuracy of the spectra, and the rationale of the work.

The editors point out that, in the enthusiasm for the successes of infrared spectroscopy in the postwar period, the complementary value of Raman spectra in the study of organic structures has been somewhat overlooked. Whereas infrared spectra give information on asymmetric vibrations of a molecule, Raman spectra complete the picture by responding to symmetrical vibrations. Having the two adjacent to each other thus has the value of giving a reasonably complete picture of the "mechanical" vibrations of a molecule.

This work is in loose-leaf form, and will comprise three deliveries to fill altogether two volumes with spectra of about 1000 selected compounds.

\* Unsigned book reviews are by the Book Review Editor.

**Saturated Heterocyclic Chemistry. Volume 2.** Edited by W. PARKER (University of Stirling). The Chemical Society, London, 1974. 407 pp. £13.50.

This volume in the series Specialist Periodical Reports covers the calendar year 1972. It is arranged according to ring size, with a final chapter on bridged systems. Within the chapters, the material is grouped under the headings Physical Methods, Formation, and Reactions. The aim has been to review the developments of the year with a limited amount of selectivity. The large amount of material covered can be appreciated from the fact that the chapter on three-membered rings alone contains 423 references. The chapter entitled "Medium-sized Rings" also contains a section on macrocycles, in which crown ethers and related amines are discussed. There is an author index.

**Statistical Thermodynamics.** By DONALD A. MCQUARRIE (Indiana University). Harper and Row Publishers, New York, N.Y., 1973. xi + 343 pp. \$14.95.

This book is the first fifteen chapters of a larger work on statistical mechanics scheduled for publication this year. The author states that the book is designed as a text for a first-year graduate course; for this, it is well suited.

The material covered in this book may be divided conveniently into three parts. The first part, comprising one chapter (1) of 34 pages, consists of a very brief exposition of classical and quantum mechanics and a discussion of some mathematical concepts (such as Legendre transformations) not generally covered in an undergraduate course in thermodynamics. The second part consists of four chapters (2, 3, 4, and 7) of 62 pages and deals with the fundamental definitions and postulates of statistical mechanics. The third part (ten chapters, 232 pages) attempts to show the power of statistical thermodynamics by treating a variety of topics dealing with gases (ideal monatomic, ideal diatomic, ideal polyatomic, and imperfect), crystals, liquids, and polymers.

The author, a student of T. L. Hill, states that his approach is similar to that found in the latter's "An Introduction to Statistical Thermodynamics." In general, the principal difference between these two books is one of scope and, at times, depth of coverage. Despite a somewhat narrower scope and despite its obvious paral-

leism to Hill's text, I find this book to be of considerable interest especially for its stated purpose. In my opinion, McQuarrie presents the material in a way which pedagogically is more easily followed. Furthermore, this volume has almost 50% more exercises (448 in all) than Hill's work, and the text is very well documented with original literature citations. In addition, each chapter has an extensive additional reading list.

This book, as well as Hill's book, requires a mathematics background through linear differential equations with constant coefficients. Other topics such as the method of Lagrange multipliers, Fourier integrals, and the Dirac delta function are treated in the text or in the appendixes.

My only objection to this book is the direct references to chapters not found in this volume but to be found in the promised, expanded version of this text. This leaves me with a sense of being cheated and spoils an otherwise excellent book.

**Norman F. Bray, Herbert H. Lehman College**

**The Interpretation of Geological Phase Diagrams.** By ERNEST G. EHLERS (The Ohio State University). W. H. Freeman and Co., San Francisco, Calif. 1972. iii + 280 pp. \$12.50.

Thermodynamic phase diagrams are complicated, and their usefulness is often dependent on the skill of the physical chemist to make them serve his purpose or application. The subtleties seem to be understood only by a small group of "phase diagram buffs" who are students of topological thermodynamics.

Ernest Ehlers has attempted to simplify the application of known geological phase diagrams by giving his interpretation of a number of one-, two-, three-, and four-component silicate, oxide, and sulfide systems. He has not used thermodynamics, and he has avoided a fundamental topological approach. The objectives of his book have been met in that it shows how to deduce crystallization paths of minerals from phase diagrams in a way that will not scare a novice.

The book closely parallels similar treatments in metallurgy, but differs in its more extensive and detailed discussion. Probably the greatest weaknesses of the book arise from the very detail. A conflict occurs when the author tries to simplify his interpretations by giving excessive description that occasionally tends to be confusing and complicated.

As might be expected of a book in its first issue, this one has its share of errors—some conceptual, some in printing, and some organizational. Hopefully, future editions will deal with degenerate systems which are so common geologically.

**P. M. Bell, Geophysical Laboratory, Washington, D.C.**

**Crystalline Solids.** By DUNCAN MCKIE and CHRISTINE MCKIE (University of Cambridge). John Wiley & Sons, New York, N.Y. 1974. x + 628 pp. \$17.75.

This is an introductory text "intended for students . . . in the fields of mineralogy, inorganic chemistry, metallurgy . . ." but it is doubtful that it will appeal to students or instructors of any but the first of these groups.

The book is divided into two parts. Part II is the shorter part (128 pages) and is devoted mainly to thermodynamics with short chapters on compositional analysis and on experimental methods of synthesis and determination of phase diagrams. This part of the book is a little too short and restricted in scope to serve as a useful first introduction to thermodynamics. It might provide a useful review for students of mineralogy for whom it is clearly intended.

Part I (the bulk of the book) is more successful, but in a limited

area. The first 268 pages are devoted largely to crystal symmetry and its determination by X-ray diffraction. This is excellent and detailed; indeed in some places it reads almost like a laboratory manual. By way of contrast, the discussion of methods of determining crystal structure is quite superficial.

There is a chapter on crystal chemistry that is not very good and a chapter titled Crystal Physics that is a disaster. This latter chapter is devoted mainly to diffusion and to thermal expansion and contains the remarkable statement that ". . . crystal physics yields results that . . . are in detail of little interest in other fields of solid-state study."! The authors' prejudices are most clearly shown here, as this chapter is followed by the final chapter of Part I which is more than twice as long, and is devoted to a good elementary account of crystal optics and the use of the polarizing microscope.

In short, the book is very good on the topics traditionally taught to mineralogists and will probably fill a real need for textbooks in this area. On the other hand, it is too unbalanced to be of much use in other disciplines. There is, for example, no account of topics such as band structure, lattice vibrations, and the reactivity of solids, and no more than a passing mention of lattice defects and their influence on properties, or of stereochemistry. This is a pity because with the dramatic growth of solid-state chemistry in the last decade there is a very real need for a good introductory text in this area.

**Michael O'Keefe, Arizona State University**

**Microbial Metabolism.** Edited by H. W. DOELLE (University of Queensland). Dowden, Hutchinson, and Ross, Inc., Stroudsburg, Pa. 1974. xiii + 424 pp. \$25.00.

This collection of papers provides, in one volume, many of the classic studies in microbial metabolism, beginning with Schwann's "A Preliminary Report Concerning Experiments on the Fermentation of Wine and Putrefaction" and including papers by Pasteur, Buchner, Emden, Meyerhof, Krebs, Entner, Winogradsky, Beijerinck, and Kornberg. Articles are translated into English when necessary, and each is accompanied by editorial comments. General topics covered are early stages of microbial metabolism, carbohydrate metabolism, metabolism of inorganic compounds, aromatic carbon metabolism, and anaerobic fermentation.

**M. C. W. Smith, Ann Arbor, Michigan**

**Quantum Electrodynamics.** By G. KÄLLÉN (the late, University of Lund, Sweden). Translated from the German by C. K. IDDINGS and M. MIZUSHIMA (University of Colorado). Springer-Verlag, New York, N.Y. 1972. xviii + 233 pp. \$10.80.

The late Gunnar Källén was a leading authority on the formalism of quantum electrodynamics. He first developed the concept of renormalization outside the context of perturbation theory and also demonstrated that, on the present level of the theory, at least one renormalization constant must be infinite. Källén's monograph presents a rigorous and compact development of the principal results of quantum electrodynamics. His wonderful insight and aesthetic sense are much in evidence, and he always seems to come up with the best way of looking at each aspect of the formalism. The order of topics is fairly standard, running through the free electromagnetic field, the free Dirac field, their interaction, and some elementary applications. The final chapter is on the theory of renormalization, largely shaped, of course, by the author's own viewpoint.

**S. M. Blinder, University of Michigan**