with the usefulness of the thermodynamic approach (if such exist), and the physical chemist unfamiliar with the more biochemical applications of his science. It is this third category for whom the book is most useful.

Obviously, a book this size could not present a thorough development of the fundamentals of physical chemistry *and* a thorough coverage of the biochemical applications. The sections dealing with fundamental physical chemistry are foreshortened and "telescoped." This leads to statements which, without proper qualification and explanation, are not strictly true. For example, here are a few: "the activity coefficient varies between the limits 0 and 1" and "ions are found to have minimal values of f . . . of the order of 0.5," p. 83; "activity coefficients are the same in solutions of the same ionic strength," p. 87; (from Debye–Hückel equation) "r" is termed "average" ionic radius p. 88, etc. For these reasons, the reader should have his physical chemistry well in hand *before* starting this book.

Despite this major shortcoming (it would require a monumental volume to give adequate coverage), the book serves a useful purpose. The style is easy to read though verbose in spots, the examples are well chosen, and the book provides a handy summary for a large specialized field in which such summaries are few. As a text, the book would require supplemental reading. It is best suited as a desk copy providing a quick review or a springboard to more detailed, comprehensive literature.

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Thermodynamics. An Advanced Treatment for Chemists and Physicists. Third Edition. By E. A. GUGGENHEIM, M.A., Sc.D., F.R.S., Professor of Chemistry in the University of Reading. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y., 1957. xxii + 476 pp. 16 × 23 cm. Price, $9.75.

Thermodynamics can be approached from two widely different points of view. The first point of view, that typically used in instruction in American Chemistry Departments, conceives thermodynamics to be a means of explaining some very interesting physical phenomena. The other point of view, that typified by this book, conceives thermodynamics more as an end in itself, a kind of mathematical game in which the object is to derive as many equations as possible from as limited a set of postulates as possible—the quantitative answers that may be derivable from these equations are treated as of secondary interest.

Professor Guggenheim's objective is a clean cut exposition of the mathematical principles and relationships in the field of thermodynamics, and he is interested in the physical phenomena mainly in that they provide a test for his equations. Usually he loses interest as soon as the final equation is presented and goes on to a new subject to him more exciting than exploring the physical implications of the equation. As one of many examples of this attitude may be cited the last section of the chapter on Solutions of Electrolytes. A set of equations is derived from which may be obtained the concentration of a base in a solution relative to the concentration in the surface layer. The equations are not applied to any specific examples. No comment is made about whether or not the equations have ever been applied or even about whether the data suggest that a lower or higher relative concentration of base is to be expected in the surface.

The value of the book lies in the excellence of its presentation of thermodynamic theory. The book is not mathematically difficult. Development of each step of an argument from the preceding step is very carefully presented so that the reader should have no more difficulty with the mathematics than with that in more elementary texts in thermodynamics. The two long chapters, 1 and 3, constitute in fact an exceptionally clear summary of the fundamental principles of thermodynamics and of the mathematical relationships used in analysis of thermodynamic problems.

Professor Guggenheim's presentation of thermodynamic theory leaves the reader with an impression of tremendous authority. Part of this sense of authority stems from his obvious familiarity at first hand with all the major contributions to thermodynamic thought. Part of it stems from his manner of presentation. He clearly is never content to accept the work of others without thinking through in his own way the entire question under consideration, and in the end he never hesitates to present his own view without apology.

The third edition of the book differs from the first two mainly in that a final short chapter on Onsager's Reciprocal Relations has been added, and in that the material on solutions has been reorganized. The discussion of Onsager's Relations is restricted to isothermal systems and illustrated mainly by application to electrokinetic effects. In the first of the chapters on solutions, a quantity called the *excess molar Gibbs function* is introduced and discussed. Discussions of mixtures whose fugacities f are related to mole fraction x by $RT \ln f_1 = x_2^2 w$ has been made more general by treatment of w as a function of temperature and pressure.

The organization and scope of the book can probably best be illustrated by citing the chapter headings in order: Introduction and Fundamental Principles; Digression on Statistical Thermodynamics; Some Relations of General Validity; Systems of a Single Component; Gaseous, Liquid and Solid Mixtures; Solutions, Especially Dilute Solutions; Systems of Chemically Reacting Species; Solutions of Electrolytes; Electrochemical Systems; Gravitational Field; Electrostatic Systems; Magnetic Systems; Radiation; and Onsager's Reciprocal Relations. The book is clearly and attractively printed and is nearly free from typographical errors.

Professor Guggenheim's book is, as its subtitle states, an advanced treatise and would not be suitable for the usual introductory chemical thermodynamics course. The work should serve, however, as an excellent reference book for the serious student who desires to acquire depth and perspective. Any chemist who plans to work in the field of thermodynamics should read the book with attention.

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Methods in Enzymology. Volume IV. Special Techniques for the Enzymologist. Edited by SIDNEY P. COLOWICK and NATHAN O. KAPLAN, McCollum–Pratt Institute, The Johns Hopkins University, Baltimore, Maryland. Academic Press, Inc., 111 Fifth Avenue, New York 3, N. Y. 1957. xii + 979 pp. 16 × 23.5 cm. Price, $24.00.

The phenomenal progress which enzyme chemistry has made in recent years may be ascribed to the development of refined techniques and the application of modern equipment. This volume deals with such special techniques which have been employed in enzyme studies. The following listing of the subject matter will illustrate the nature of this volume.

In Section I physical methods for characterization of proteins include: electrophoresis; paper electrophoresis; ultracentrifugation, diffusion and viscometry; infrared spectrophotometry; X-ray diffraction; light-scattering measurements; flow birefringence; fluorescence techniques; solubility criterion; and essential groups in enzymes.

In Section II there are techniques used in metabolic studies: assay of respiratory enzymes; artificial electron acceptors; perfusion techniques used in soil metabolism; the Hill reaction; nitrogen-fixation; certain micromethods used in enzyme assays; histochemical methods, and electron microscopy.

In Section III the following techniques for isotope studies are described: measurement; synthesis and degradation of isotopically labeled carbohydrates and carbohydrate intermediates; isotopic carbon patterns in bacterial fermentations; experiments with the tricarboxylic acid cycle; purines and pyrimidines; biosynthesis of protoporphyrin; amino acids and proteins (synthesis, isolation and degradation); labeled steroids; methyl groups (biosynthesis and transfer); labeled sulfur; labeled fatty acids; labeled compounds in phospholipid metabolism; labeled coenzymes; and I^{131}-labeled compounds.

The authors of these contributions are prominent representatives of their respective fields. Because most of these procedures have appeared widely-scattered in a large num-