Free Radicals: An Introduction. By A. F. TROTMAN-DICKENSON, Lecturer in Physical Chemistry in the University of Edinburgh. John Wiley and Sons, Inc., 440 Fourth Ave., New York 16, N. Y. 1959. 142 pp. 11 × 17 cm. Price, $2.50.

This work is chiefly distinguished from earlier books on free radical chemistry in its unified treatment of both the gas and liquid phase. Attention is given to methods of production of free radicals and their properties. Included is a short section on spin resonance techniques for the measurement of free radical concentrations. A systematic survey of reactions of chlorine atom, hydrogen atom, sodium atom, alkyl and alkoxy radical reactions is presented. A very illuminating discussion of the kinetics and thermodynamics of the association of triarylmethyl radicals and other resonance stabilized radicals is well worth digesting. Polymer chemists will be interested in the author's treatment of the kinetics of elementary polymerization reactions. The Evans–Polanyi theory has come back into vogue after a long sleep and the author again defends it although not nearly as strongly or in as much detail as Semenov's recent volume. Finally, the recent work on insertion reactions of methylene radicals is discussed. Notable omissions are the kinetics of the reactions of oxygen atoms, nitrogen atoms and hydroxyl radicals. It is, nevertheless, an accomplishment for the author to have said so much with so few words.

NATIONAL BUREAU OF STANDARDS
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The Physical Properties of Polymers. Comprising papers read at the Silver Jubilee Symposium organized by the Plastics and Polymers Group held in the University of London, April 15–17, 1958. S.C.I. Monograph No. 5. By the Plastics and Polymer Group. The Macmillan Company, 60 Fifth Avenue, New York 11, N. Y. 1959. iv + 293 pp. 14.5 × 21.5 cm. Price, $6.00.

This collection of papers is a valuable one, especially for those concerned with industrial applications of polymeric plastics. Most of the papers deal with applications of various experimental techniques to specific polymer problems; many are concerned with viscoelastic and electrical properties.

As is now well known, the existence, type and degree of crystallinity in a polymer greatly affect its macroscopic properties. This subject is ably dealt with in a general way by C. W. Bunn and further treated by P. W. O. Wijga in a paper on "Structure and Properties of Polypropylene" and in one by A. E. Woodward and J. A. Sauer on "Dynamic Mechanical Behavior of Partially Crystalline Polymers."

Also of special interest to the reviewer are a paper on "Optical Properties of Strained Amorphous Polymers" and one by A. R. Payne on "The Mechanical and Dielectric Temperature/Frequency Equivalence of Polymers: GR-S." In the latter the author shows how beautifully the frequency and temperature dependence of the response of polymeric materials can be represented by master curves, according to the method developed by J. D. Ferry and co-workers.

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Polymer Reviews. Volume 2. Linear and Stereoregular Addition Polymers: Polymerization with Controlled Propagation. By NORMAN G. GAYLORD, Interchemical Corporation, New York, and HERMAN F. MARK, Institute of Polymer Research, Polytechnic Institute of Brooklyn. Interscience Publishers, Inc., 250 Fifth Ave., New York 1, N. Y. 1959. x + 571 pp. 16 × 23.5 cm. Price $17.50.

In a foreward to this book Professor G. Natta states that "It is perhaps for the first time in the history of macromolecular chemistry that a scientific discovery has been followed so rapidly by such a vast amount of research in scientific and industrial laboratories." The discovery referred to is the discovery of stereoregular polymers such as isotactic polypropylene. The scientific and industrial importance of this field provided the motivation for the book.

The initial discoveries of Natta (based on the Ziegler catalyst) which made a profound impact on the chemical world occurred in 1954, although significant work in this field by Schildknecht and Huggins had been published even prior to this. The book attempts to include references to all articles which appeared on this subject before February, 1959.

By collecting and collating the tremendous flood of information, much of it in relatively inaccessible patents, the authors have performed a most valuable service for the industrial and academic research worker. However, it is impossible at this time to present a truly unified discussion of all the diverse scientific and technical discoveries in this area since, at least in the field of mechanisms, few papers of genuine perspicuity and scope have appeared. In their effort to achieve timeliness and comprehensiveness the authors have necessarily had to sacrifice, at least in part, elegance, unity and discrimination.

The authors describe in their preface the problems of dealing with an ever increasing avalanche of new data and new papers which kept appearing throughout the preparation of the book. They are to be commended for their ability to confine this avalanche between the covers of a book and make it available to a most interested chemical public.

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Analytical and Canonical Formalism in Physics. By ANDRÉ MERCIER, Head of the Department of Theoretical Physics and Professor of Philosophy of Science, University of Berne. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1959. viii + 222 pp. 16 × 23 cm. Price, $6.75.

This book, as its title would imply, is hardly a text for the beginner in theoretical physics, nor a source for the classical chemist seeking more information about the nature of recent advances in physics. However, it is also not, as one might fear from the title, a pure exercise in mathematical abstractions, devoid of physical contact with reality. Although the author does actually "start at the beginning and proceed to the end" a considerable acquaintance with analytical mathematical methods is expected of the reader.

The author starts with the formal methods of the treatment of mechanics developed in the nineteenth century through the work of Lagrange and Hamilton. The description, although formal, is by no means devoid of reference to simple physical examples and the text is interspersed with problems for solution by the reader. Early in the book the electrodynamic field is introduced as an example. Thus the parallelism of the methods of particle dynamics and of field dynamics is kept in constant view throughout the treatment. Although quantum mechanics as such is not treated (Quantum Theory is the title of the last one page half of the last section of the last chapter) the text is clearly oriented in such a manner that the transition from the classical to the quantum treatments is made as naturally as possible. Many references made in the text to this transition do occur earlier. Clearly the author is writing for an audience that he expects to be acquainted with the formalism of quantum mechanics.

The book is an excellent text for the purpose for which it was written, to show the great breadth of the nineteenth century formalism, and how readily it can be adapted to new physical theories.

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Gmelin's Handbuch der Anorganischen Chemie. Achte Völlig Neu Bearbeitite Auflage. **Magnetische Werkstoffe.** Magnetische und Elektrische Eigenschaften. Zugleich 2. Ergänzungsband zu Eisen Teil D. System-Nummer 59. E. H. ERICH PIETSCH, Editor. Verlag Chemie, G.m.b.H., (17a) Weinheim/Bergstr., Pappelallee 3, Germany. 1959. xxxviii + 580 pp. 17.5 × 25.5 cm. Price, Kart. DM 321.--; Geb. DM 326.--.

It may startle some to learn that Gmelin, a veritable citadel of inorganic chemistry, sees fit to devote over 500 pages

to ferromagnetic substances. But the result is a volume of the highest value (and nearly the highest price).

The volume opens with general remarks and general references, symbols, units, theories of ferromagnetism and related topics, and then launches into a wealth of carefully organized information on metals, alloys, oxides and other ferromagnetic substances. Electrical properties are included, especially as these may be related to magnetization. Convenience of use is increased by marginal headings in English. A very few ferromagnetic substances appear to have escaped attention. Of these, metallic gadolinium seems to have been intentionally omitted (the rare earth "garnets" are adequately treated) and silver difluoride has been overlooked. The volume concludes with over 100 pages of patent references, formula index and trade names.

While the exhaustive literature survey terminates at the end of 1955, there are more than a few references through 1957.

The volume is recommended without reservation to anyone interested in ferromagnetism or in solid state inorganic chemistry. It should be required reading for those still unaware of the modern position of inorganic chemistry.

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Ultracentrifugation in Biochemistry. By HOWARD K. SCHACHMAN, Biochemistry and Virus Laboratory, University of California, Berkeley, California. Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1959. xii + 272 pp. 15.5 × 23.5 cm. Price, $8.80.

It appears that it was the original intent of the author to provide a review on sedimentation analysis for the *Advances in Protein Chemistry*, perhaps a companion article to the earlier Gosting article, "Measurement and Interpretation of Diffusion Coefficients of Proteins," which had appeared in the *Advances* in 1956. However, it came to be felt that recent developments in the theory and practice of sedimentation analysis had been sufficiently extensive in recent years to require space beyond the bounds of the conventional review for adequate description. The result is an impressive independent monograph, one we have read from start to finish with undiminished interest. Above all, it teaches that sedimentation analysis is a subject of many ramifications.

Except for a short, largely historical introduction, the monograph proper is written in six sections. In the first of these longer sections, of title "General Considerations," ultracentrifugation is divided into three areas: sedimentation velocity, sedimentation equilibrium and the approach to sedimentation equilibrium or the transient states. In addition the Lamm differential equation of the ultracentrifuge is derived. Following a section called "Experimental Aspects," the fundamental principles of each of these three major divisions of the subject are considered in separate sections. The final section, "Interpretation of Sedimentation Data," describes additional items which have to do with the transport experiment. The discussions which form the sections "Experimental Aspects" and "Sedimentation Velocity" require some sixty per cent. of the text pages. The main sections are followed in the make-up of the volume by extremely useful listings: some twenty-four pages of "References," "Glossary of Terms," "Author Index" and "Subject Index" items.

So, in large part, the monograph deals with the principles and practice of velocity sedimentation as they are now being applied in the solution of biological and medical problems. Nowhere is the author more at home than when he is describing a wide variety of experimental techniques. Considerations of the correct procedures for the evaluation and interpretation of sedimentation coefficients are uniformly well handled, and relationships between the measured coefficient from a given type of experiment and the concentration to which this datum corresponds are established. The correlation of sedimentation and diffusion measurements to produce equations for solute molecular weight is treated much in the fashion of the classical approach to the traditional two-component, incompressible system.

The classification of the methods to obtain the familiar Svedberg equation, Section VII, 1, seems to be not entirely clear. There is the classical kinetic theory or microscopic analysis in its various forms, a force–friction concept which is applicable only to the two-component, incompressible system. However, we would describe the more recent derivations, those which contain in them the implementation for extension to multicomponent systems, as being momentarily two in number, but perhaps eventually only one in kind. They are: (a) the "quasi-thermodynamic" or "dynamical" derivation in which the force–friction concept is retained (Lamm, 1953, 1959).

(b) The use of the negative gradient of the total potential as the driving force in sedimentation to adapt the general theoretical and practical flow equations of the thermodynamics of irreversible processes to the sedimentation velocity experiment (Hooyman, *et al.*, 1953, 1956; *cf.* also Williams, *et al.*, 1954, 1958).

One of the neglected subjects in sedimentation analysis is that of charge effects. The early fundamental and rather extensive treatments of Svedberg, Tiselius, Lamm and Pedersen (to which references are given) have stood the test of time, but their teachings have been sometimes forgotten; we had hoped now to find that they had received a somewhat more definitive and up-to-date interpretation and review. Because of these charge effects it is necessary to study proteins and other macro-ions in systems of three components, the additional solvent component being "supporting electrolyte" in an amount which is "sufficient" to repress these charge effects. In its presence another concentration gradient is produced in the ultracentrifuge cell, either at equilibrium or in transport. Now, as we have intimated, the simpler equations become inadequate, and although much theoretical work remains to be carried out, the pathways have been marked by which the relationships can be improved. In the meantime, the practical biochemist must be continually alerted to this situation.

Even with systems which contain only neutral molecules, the use of mixed solvents in an experiment has been the cause of much misinterpretation. In general, as soon as one comes to study "Multicomponent Systems," Section VII, 5, our complications enter in the description of a process which is basically simple, and one cannot carry over directly these less sophisticated approaches in the theoretical analyses. Thus, the derivation of equation (136) should be re-examined. What Peller has suggested, *cf.* footnote to pages 235–236, is that the evaluation of "binding" data from sedimentation velocity experiments in ternary systems without reference to diffusion measurements may be tenuous. The terms to include these diffusion measurements, or additional friction coefficient terms, do not appear in the equation (136) and in others based upon it. Lastly, in connection with this sub-section, we note with regret that the definition of particle volume, v, divided by mass, m, is retained for the partial specific volume.

However, we must look in another direction. In the monograph, the mathematical apparatus has been kept at an intermediate level because the individual interested in ultracentrifugation is likely to be a biochemist, and it is really to him that the book is addressed. With the excellent description of newer experimental techniques, the clear statements of basic ideas and principles and the extensive bibliography and indices, such a worker cannot afford not to have this book as companion and friend.

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