pounds cites over 600 references and covers many classes of compounds. The discussion of the mechanisms of sulfur reactions by R. E. Davis is a unique presentation. Davis was a member of the group of students of Paul D. Bartlett which contributed so significantly to our understanding of the chemistry of elemental sulfur, and he quotes extensively from Harvard Ph.D. theses as well as from published material. The discussion of the analytical chemistry of sulfur ions will be very helpful, particularly since many of the references in this field are less well known than they should be. The chapter on the lower oxy-acids of sulfur also is a good review of this subject; thiosulfates are not covered, however. The discussion of the orbitals of sulfur and its compounds is worthwhile and original. R. J. Gillespie reviews the use of sulfuric acid as a solvent, and the late P. W. Schenk and R. Steudel cover sulfur oxides.

The authors in this work have done such a fine job in reviewing the topics they cover that I must confess great disappointment at finding several areas overlooked completely or badly neglected. For example, the discussion of structures of inorganic compounds omits x-ray data on organometallic complexes of sulfur ligands. Also, although many tables of bond angles are included, virtually no data on bond lengths are given. None of the chapters include summaries of bond dissociation energies. The radical reactions of sulfur compounds are almost totally ignored. Most strikingly, kinetics, photochemistry, and radiation chemistry are almost completely neglected.

Sulfur is a metalloid and is important in both inorganic and organic chemistry, and even in a book such as this one some organic chemistry should be covered. The editor has recognized this, and the chapter by Davis and one on the biological sulfur cycle review some of the organic chemistry and biochemistry of sulfur. The treatment is more condensed than I would have wished, and some topics which should have been covered are omitted. For example, the oxidation of xylenes to phthalic acids by elemental sulfur, a commercial process, is not mentioned.

In view of the wealth of bibliographic information, it seems an inexcusable oversight to omit an author index. In addition, the subject index is not as detailed as would be appropriate in this type of encyclopedic reference. In other regards, the book is attractively designed. The tables and equations are laid out clearly and with few typographical errors.

In the preface, the editor comments that he and the late S. H. Pollard initiated work on this volume several years ago. The death of Pollard slowed the production of the book, and many of the chapters are not as up to date as I would have liked. Nevertheless, the volume is a success in most of what it attempts to do. It certainly should be purchased by every large university library and by all research institutes interested in the chemistry of sulfur. It will prove to be an indispensable compendium of references for the subjects which it covers in strength. The highly eclectic nature of the topics covered and the price undoubtedly will rule out its purchase by individuals. There appears to be a renaissance in the study of sulfur compounds and sulfur reactions, and this book is a welcome addition to the growing shelf of review volumes in the field.

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A New Mechanics

Phase-Space Dynamics of Particles. ALLAN J. LICHTENBERG. Wiley, New York, 1969. xvi + 336 pp., illus. $16. Wiley Series in Plasma Physics.

The student of physics knows mechanics as a rather stodgy course in the standard curriculum, used mainly to screen academic sheep from goats. Little is left from its proud history as a model for physical theory, and indeed for all science. It has become seemingly useless, and a reasonable recounting of its triumphs requires presentation of methods currently thought too complex for the tender minds of students. While the classical subject of mechanics has thus been dying, a growing band of practitioners has, for nearly a generation now, been constructing a new mechanics. Like its sister subject, the new optics, this new discipline is an applied science, designed to serve other disciplines while retaining the elegance and precision that marked its predecessor. The basic motivation for this new development came from the demands of high energy physicists for ever more powerful, and therefore more costly, accelerators. With the risk of an expensive failure always close at hand, the study of beam dynamics in particle accelerators underwent a rapid growth. Somewhat later, the developing interest in plasma physics led to extensive further developments, with interactions between particles playing a more important role than in the accelerator problem.

This book is a competent presentation of the new mechanics, as applied in these two related areas. The unifying concept is that of the phase space of a dynamical system, here specialized in a very important and useful way. Any problem involving a beam or a plasma is in principle a many(N)-body problem which requires for its description a $6N$-dimensional phase space. For the problems of interest in this book, the independence (or near independence) of the individual particles allows a description of the beam or plasma as a density of representative points in the reduced 6-dimensional phase space of *one* particle. This is an enormous simplification of the true problem, and gives excellent results under a wide range of conditions.

The development of the relevant concepts of Hamiltonian dynamics in the first three chapters is excellent and of general utility, and the last two chapters of applications successfully give the flavor of the new mechanics. Generally harmless misprints unfortunately abound.

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Books Received

Advances in Activation Analysis. Vol. 1. J. M. A. Lenihan and S. J. Thomson, Eds. Academic Press, New York, 1969. x + 224 pp., illus. $9.50.

Advances in Cancer Reseach. Vol. 12. George Klein, Sidney Weinhouse, and Alexander Haddow, Eds. Academic Press, New York, 1969. xvi + 320 pp., illus. $17.

Advances in Control Systems. Theory and Applications. Vol. 7. C. T. Leondes, Ed. Academic Press, New York, 1969. xiv + 314 pp., illus. $16.

Albert Einstein. Sein Lebenswerk und die Zukunft der Physik. Pascual Jordan. Huber, Frauenfeld, Switzerland, 1969. 304 pp., illus. sFr. 24.80.

Aquatic Diptera. O. A. Johannsen. Part 5 by Lillian C. Thomsen. Entomological Reprint Specialists, East Lansing, Mich., 1969. Illus. $11.25.

Chemical Bonding Clarified through

(Continued on page 1652)