

Throughout the book, one feels a lack of emphasis on problems arising from the scarcity of biochemicals, and often methods are cited for their rapidity and with little regard as to whether or not biochemicals are available in sufficient amounts. But the book is well worth having for the researcher and the student, and surely meets the author's plan "that the reader will be able to form an impression of the possibilities, limitations and achievements of each technique." The book will be useful to many, and one hopes that it will inspire some to take up the fascinating field of rapid reactions.

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Noble Gases and Their Compounds. By G. J. MOODY and J. D. R. THOMAS, Welsh College of Advanced Technology, Cardiff. The Macmillan Co., 60 Fifth Ave., New York 11, N. Y. 1964. 62 pp. + vii. 13.5 × 20.5 cm. Price, \$2.00.

After a ten-page introduction including historical background and factual data about the noble gases, pages 11 through 52 discuss the recent developments in noble gas chemistry. More than half of the 134 references end with (1962) or (1963).

The authors' stated purpose of bringing together into a convenient volume information from many different journals has certainly been accomplished. The book can easily be read in one evening and gives a quick survey of the early part of the recent interesting developments in a field of chemistry quite nonexistent before 1962. The writing was too early to include much on the now extensive aqueous chemistry of xenon, and theoretical discussions of binding have been largely ignored.

The careful reader will be bothered by numerous mistakes such as crediting a theoretical chemist with a warning about the hazards of XeO_3 in a publication dated earlier than the actual discovery (by someone else) of XeO_3 , quoting a m.p. of 100° when the quoted authors said "was observed not to melt up to 100° ," etc.

More serious than these mistakes and typographical errors is the lack of critical evaluations and even of careful reading of the papers referred to. As an example of this lack, on page 19 there are quoted values of 10 and of 15.3 kcal./mole for the enthalpy of sublimation of XeF_4 as if they were equally reliable. In fact, the former was just a guess made for the purpose of a rough calculation, and the latter was a measured value.

Many of the references quoted were preliminary announcements published quickly as notes because of the great interest in the new field. A number of these notes include mistakes that were later corrected in "Noble Gas Compounds," University of Chicago Press, a report of a conference held in April, 1963. Although the present authors include this book among their references, they evidently did not have time to read it. If they had, they could have corrected a number of these errors in the literature instead of serving to perpetuate them.

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Inorganic Ultramicroanalysis. By I. P. ALIMARIN and M. N. PETRIKOVA, U.S.S.R. Academy of Sciences. The Macmillan Co., 60 Fifth Ave., New York 11, N. Y. 1964. xv + 151 pp. 14.5 × 22.5 cm. Price, \$6.00.

According to the authors, this small book represents an attempt to present a systematic summary of the techniques of ultramicroanalysis, which they define as the analysis of masses of 10^{-6} – 10^{-12} g., using volumes of 10^{-3} to 10^{-6} ml. Soviet work in the field—particularly that of the authors—is strongly represented, of course.

About two-thirds of the book is devoted to methods of qualitative analysis. The manipulative techniques described are essentially those developed by Benedetti-Pichler many years ago. The tests suggested for the qualitative detection of various elements use conventional reagents: thiocyanate for iron, cobaltinitrate for potassium, chloride for silver, and so on.

Some minor alterations of the nonsulfide scheme of qualitative microanalysis published some 10 years ago by C. L. Wilson and his colleagues are suggested.

The chapter dealing with methods of separation is more interesting. Electrolytic separations using either platinum or mercury cathodes are described in some detail, and directions are given for electrolyzing vanadium-copper-iron and vanadium-chromium solutions, with subsequent detection of the separated elements at levels of 10 to 100 nanograms (millimicrograms).

A miniature ion-exchange column is referred to. A photograph of the column and fraction collector is shown, but details of column dimensions and flow rates are not given (many other techniques mentioned in the book are described with similar vagueness).

The section on quantitative analysis covers both gravimetric and volumetric methods. Ultramicrobalances and methods for their calibration are treated briefly in what amounts essentially to a summary of published American experience in the field.

However, in volumetric ultramicroanalysis—especially in the employment of potentiometric and amperometric methods—there is evidence of very good work, and some elegant techniques are described. Supporting data are presented in the form of titration curves.

In addition to a not-unreasonable number of typographical errors, the book contains other errors which indicate either carelessness or a lack of understanding of the material treated.

Thus in discussing the theoretical limits of application of ultramicroanalysis, the authors use as a sole criterion statistical adherence to the laws of chemical equilibrium. Hence 10^6 molecules are sufficient for a quantitative analysis accurate to 0.1% ($\sqrt{10^6}/10^6 = 0.1\%$). Little thought is required to discover the general inapplicability of this criterion.

On page 3, equation 3 is incorrectly stated to represent the fractional change in vapor pressure of a liquid as a function of the curvature of its surface. The authors have confused differences in pressure with differences in vapor pressure.

On page 97, the cantilever ultramicrobalance ("fishpole balance") is erroneously called a torsion balance, and a drawing of a cantilever balance (Figure 35) is mislabeled accordingly. (Perhaps the reviewer is unduly perturbed by this error, since the drawing is reproduced without credit from one of his papers.)

On the same page, the quantity J appearing in equation 13 is defined as the moment of inertia of the fiber, whereas actually it is the moment of inertia of its cross section about the line of intersection of the neutral plane with the cross section.

The general impression created is that the work done by the authors in volumetric ultramicroanalysis is quite good, but that in attempting their more general survey of the field of ultramicroanalysis, they have been hasty and uncritical.

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The Chemistry of Imperfect Crystals. By F. A. KROGER, Philips' Research Laboratories, Eindhoven, The Netherlands. John Wiley and Sons, Inc., 605 Third Ave., New York 16, N. Y. 1964. 1039 pp. + xiv. 6.5 × 9 cm. Price, \$33.00.

Traditionally, chemistry has dealt more with reactions between atoms and molecules in gaseous or liquid media than in solids. Although chemists as long ago as 1914 were aware that non-stoichiometric solids (Bethollides) existed, it was not until attempts to explain their electrical properties were made that the great importance of crystal imperfections (impurities and lattice defects) became evident. Gudden and Pohl (1920–1930) were among the first to recognize this. However, it was Schottky and Wagner who showed how statistical thermodynamics and the law of mass action could be usefully applied to reactions in crystals involving vacancies and electrons, as well as atomic species.

Parallel to this development of the chemistry of crystal imperfections, there has been a corresponding, and even greater, in terms of numbers of publications, development of the physics of crystal imperfections beginning with A. H. Wilson's energy band model in 1931. The gap between the chemistry and physics of crystal imperfections has steadily closed with time, and today the common meeting ground is the microscopic attack on the nature of the imperfections themselves as disclosed chiefly by optical and electron spin resonance investigations backed up by crystal field theory.

Kroger's book, as the title states, is concerned primarily with the chemistry of imperfections. In this pursuit, it is by far the most comprehensive and complete work of its kind published to