orientation in a complex area of preparative chemistry. Adequate warnings are given regarding both the flammability and the toxicities to be guarded against when handling phosphorus and its compounds.

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Ion Exchange Separations in Analytical Chemistry. By OLOF SAMUELSON, Professor of Engineering Chemistry, Chalmers University of Technology, Goteborg, Sweden. John Wiley and Sons, Inc., 440 Park Avenue S., New York 16, N. Y. 1963. 23.5 × 15.5 cm. 474 pp. Price, $9.50.

The use of ion exchange in analytical chemistry has increased tremendously during the last 10 years or so. The earlier book published by Samuelson, in 1953, "Ion Exchangers in Analytical Chemistry," has been partly responsible for this growth. Samuelson's latest book is an entirely new book and not merely a second edition of the earlier book.

"Ion Exchange Separations in Analytical Chemistry" is divided into three parts. The first part is concerned with the fundamental properties of ion exchange resins and with the principles and mechanisms of ion exchange. The second part deals with the technique of simple separations and of the general technique used in ion exchange chromatography. The third part covers applications, and has been restricted to separations used in determinations of inorganic substances.

This is essentially a practical book, although essential theory has not been slighted. The theory of ion exchange resins and equilibria is adequate and rather easy to follow. The chapter on application of plate theory to ion exchange presents information vital to the understanding of column separations. A short but interesting chapter on ion exchange in nonaqueous solutions is included.

The "applications" part alone is worth the price of the book. A chapter on metal separations is excellent and extensive (110 pages). Some general techniques for separation of metal ions are described, then methods for separation of groups of metals within the periodic table are given. A shorter chapter deals with the chromatographic separation of anions.

The literature coverage is excellent, but because of the time required for editing and publication, papers published within approximately the last two years are not mentioned. So long as research in analytical uses of ion exchange continues at such a rapid pace, it is hoped that the author will periodically bring his book up to date through revised editions.

This book is highly recommended to the chemist interested in the use of ion exchange in analysis and analytical separations. I feel that it is the best book available on this subject.

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Spectrometric Identification of Organic Compounds. By ROBERT M. SILVERSTEIN and G. CLAYTON BASSLER, both Senior Organic Chemists, Stanford Research Institute. John Wiley and Sons, Inc., 605 Third Avenue, New York 16, New York. 1963. 23.5 × 30.5 cm. 177 pp. Price, $8.50.

"Spectrometric Identification of Organic Compounds" is a pioneering effort to bring the classic organic qualitative analysis course abreast of modern research methods. The approach is radical—identification is based solely on spectrometric methods—chemical methods (including combustion analysis) are forsworn. Structures are arrived at solely on the basis of mass spectra, infrared spectra, nuclear magnetic resonance spectra, and ultraviolet spectra. It may be argued by the reader that "Spectrometric Identification of Organic Compounds" is not a replacement for qualitative organic analysis but rather a new instrumental analysis for organic chemists. It is this reviewers' emphatic opinion that this should not be the case. Identification of organic compounds in the research laboratory is now primarily a matter of physical methods.

The book consists of an introductory chapter, chapters on mass spectra, infrared spectra, nuclear magnetic resonance spectra, and ultraviolet spectra, a chapter with 20 sets of spectra with detailed analysis, a chapter containing 10 sets of spectra with Beilstein references to answers, and a chapter of 10 sets of spectra with no answers. The order of the various types of spectra gives an indication of the relative emphasis given to each. Mass spectra are made the basis of analysis. This emphasis on mass spectra will compensate in part for the lamentable lack of coverage of this topic in many courses dealing with physical methods. The decision to include a chapter tying together the various spectral methods by analysis of specific compounds was an excellent one. The corollary decision to reduce to a minimum specific examples in the first five chapters was exceedingly unfortunate.

The chapter on mass spectra contains a rather ponderous (in terms of chapter size) appendix of masses and isotopic abundance ratios for various combinations of carbon, hydrogen, nitrogen, and oxygen (mass 12–250) which is required for the problems. The discussion of mass spectrometry is quite satisfactory, but it would have been nice to have at least one example of the application of mass spectrometry to a complex molecule (such as one of the indole alkaloids).

The chapter on infrared spectrometry is quite good as an introduction to the subject. There is no mention of the relationship of infrared spectra to near infrared and Raman spectra. The examples of hydrogen bonding studies shown (p. 61) have the spectra upside down relative to other infrared spectra. This will be confusing to the student. Readers will miss an excellent follow-up to this introductory chapter since no reference is made to Nakanishi's book on infrared spectra.

The chief disadvantage of the chapter on nuclear magnetic resonance spectra is the lack of examples. Only three examples are shown and unfortunately the first two of these were run at 30 Mc. with benzene as reference standard. It would certainly have been better to replace these with 60 Mc. spectra calibrated relative to tetramethylsilane. Additional examples of spectra would have added clarity at several points in this chapter, for example, in the discussion (p. 81) of double-irradiation techniques. The coupling constants given as appendix D are somewhat dated and could have been brought up to date. One cannot help but deplore use of the term peaklets to designate small peaks in spectra, n.m.r., or otherwise.

The chapter on ultraviolet spectra is very satisfactory. It would seem desirable to have shown at least one ultraviolet spectrum to give the reader an appreciation of their general appearance. There is one serious omission in the coverage of ultraviolet spectra. No mention is made of the additivity principle in regard to the spectra of molecules containing two or more isolated chromophores.

Chapter six in which sets of spectra (MS, IR, NMR, and UV) for twenty compounds are analyzed in detail will be the most rewarding chapter for the student. If the reader solves these problems before consulting the analysis, he will be annoyed to find that for compound 4 (p. 115), "We overlook several minor peaks in the NMR spectrum as evidence of small amounts of an impurity," after he has been informed (p. 104), "The samples are quite pure."

The problems in chapters seven and eight are excellent and students approaching spectra for the first time will find them challenging. In problem 9 (p. 170) of chapter eight the P + 1 peak is 7.00% of the parent ion peak rather than 7.36% as given.

Over-all this is a good book and one which should be widely used. The level of the book is about right for the first year graduate student. More advanced students and chemists not familiar with spectrometric methods of organic chemical structure analysis will profit by studying it. Most organic chemists will find the problems a pleasantly amusing intellectual exercise. It should be emphasized that this book is an introduction to the application of spectrometric methods to structural problems. The serious student of organic chemistry must go deeper, especially in mass spectrometry and nuclear magnetic resonance spectroscopy.

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