

works. C1, 2, 3 are the thesis and books, but it takes time to realize that the common feature of the *A* papers is a non-mathematical one; they appeared originally in *Comptes Rendus*! References are always to footnotes in the *Comptes Rendus* papers, but in other papers were usually to bibliographical lists, and these lists have been systematically deleted. This is an irritating feature, not sufficient to deter the buyer, but it should not have occurred in such a tribute to one of the great mathematicians of our time.

PHILIP HEYWOOD

## INFRARED SPECTROSCOPY

### Spectroscopic Techniques for Infra-Red, Submillimetre and Millimetre Waves

Edited by D. H. Martin. Pp. vii+389. (Amsterdam: North-Holland Publishing Company, 1967.) 120s.

MICROWAVE spectroscopy had a burst of popularity in the immediate post-war period, for it exploited wartime technical developments. Ever since then spectroscopists have hoped to "bridge the gap" to visible light. Progress has been slow, sometimes painfully slow. The long wavelength limit of fast and sensitive infrared detectors based on photoconductivity in semiconductors crept slowly out from PbS (3  $\mu\text{m}$ ) to InSb (7  $\mu\text{m}$ ) to doped Ge (up to 100  $\mu\text{m}$ ) and finally to 2 mm using free electron absorption in InSb. Progress from the other end concentrated on sources rather than detectors and was less spectacular, limited by techniques rather than ideas, although skill and patience have pushed the backward wave oscillator and harmonic generators to around 0.3 mm. Spectroscopists have not been slow to demonstrate the potentialities of these techniques. Further technical development, exploiting lasers, parametric devices and microminiaturization, now seems certain. The possibilities for spectroscopy will increase, as will the demand for spectroscopic data on which to base new techniques.

This book is among the first to be devoted exclusively to the mm, sub-mm and far infrared regions of the spectrum. Edited by Professor Martin, who contributes to three of the seven chapters, it covers interferometers and grating spectrometers, semiconductor detectors and harmonic generators, electron beam tubes and waveguides suitable for the sub-millimetre range. Inevitably the division between optical and microwave techniques is still apparent and tends to be underlined by a multi-contributor book, but the editor has managed to maintain a commendable coherence. Altogether the book is a welcome addition to the library shelf and a must for those who, familiar with optics or microwaves, want to discover how the other half lives. Following a brief but valuable introductory chapter the relative merits of grating and Fourier transform spectroscopy are described and compared in the second and third chapters. Both chapters are excellent, but I felt there was an unwarranted bias in favour of the interferometer. The fourth chapter, which covers detectors, is written by Dr Putley and Professor Martin, who have both contributed very significantly to this field. Dr Baker's chapter on harmonic generators and diode detectors is the longest of the book and in my view unnecessarily long: it is a surprise to come to elementary band theory after Putley's chapter. The last two chapters deal with electron beam tubes and propagation techniques respectively. It seemed to me that the latter caught the spirit of the book rather better, as it shows quite clearly how to extrapolate the performance of oversized guides, beam waveguides, and so on, into the submillimetre region.

No book is beyond criticism and no review complete without critical comment. The authors could, I believe, have speculated a little more on future prospects by extrapolation: lasers receive scant mention. But such criticism is churlish. The editor and authors are to be

congratulated on a valuable addition to the literature of the subject and a real contribution to the development of the field.

ALAN F. GIBSON

## SPECTROSCOPIC PROBLEMS

### Problems in Spectroscopy

Organic Structure Determination by NMR, IR, UV and Mass Spectra. By Barry M. Trost. (New York and Amsterdam: W. A. Benjamin, Inc., 1967.) n.p.

STRUCTURAL determination in organic chemistry has been revolutionized by the application of a variety of spectroscopic techniques. Increasingly these techniques are being introduced early into the study of organic chemistry. Learning to apply these techniques calls basically for an understanding of certain procedures, often largely empirical, which are specific for each technique. The chief need is undoubtedly practice in applying these procedures. Here we have a book which is essentially a collection of spectra assembled for the student to interpret. There is no account of the procedures at all, merely a three page bibliography covering the more important books on the various techniques. Generally, there are infrared, ultraviolet (if applicable), nuclear magnetic resonance and mass spectra for each compound to be identified; an osmometer molecular weight and elemental analysis are also provided. The author has attempted to cover all the major classes of organic compounds. The student is invited to identify the compound and complete the blank pages at the end of the book in the form of an index. Thus almost the entire book is devoted to reproducing four spectra (or three in some cases) for each of two hundred compounds. For a student who already has a reasonably sound idea of the way in which each of the techniques is applied, there is opportunity here to gain practice and to develop an understanding of the complementary value of the different types of spectra in structural determination.

D. J. MILLEN

## LOW TEMPERATURE REFERENCES

### Cryogenics and Refrigeration

A Bibliographical Guide. (The Macdonald Bibliographical Guides.) By Ellen M. Codlin. Pp. xix+293. (London: Macdonald and Co. (Publishers), Ltd., 1968.) 105s. net.

THIS book presents a bibliography of published data in the broad field of artificially-produced low temperatures. Each item, a textbook, paper or journal article, is described by a brief note giving a guide to its contents. Items are placed in sections with general headings, and a subject index provides the necessary cross-references. Because the classification of some items is by no means a matter of simple definition, the occasional placing of an item under an unexpected section heading is inevitable. In general, the subject index provides the means whereby all items concerning a particular subject can be traced. Only rarely does it appear to be inadequate, for example, where the textbook by McAdams, classified under basic physics, is not indexed under heat transfer.

The general item material is biased towards cryogenic technology, and its applied subjects, with considerable reference to physical phenomena at very low temperatures, such as superconductivity. Although a very broad field of conventional refrigeration is represented, including a section on air conditioning, the applied technology of refrigeration is thinly covered. There are no references, for instance, to refrigerated containers, nor to recent work on transport vehicles, and the latest food freezing techniques, using fluidized beds or nitrogen atmospheres occur only in two items.

It is gratifying to find the inclusion of a section on aspects of safety, particularly as this covers the handling