methods available for determining impurities, only those for aluminum, boron, and certain rare earths are considered, even though the necessity for methods was mentioned in chapter 5. Chapter 4, "Determination of thorium in natural materials and in industrial products," a quite comprehensive chapter, is the best one in the book. In general, this volume will be quite useful to the analyst.

Analytical Chemistry of Thallium (Moscow, 1960), by I. M. Korenman, is quite adequately documented. The published literature on thallium is relatively meager, and this volume is consequently considerably smaller than the other monographs. The author's evaluation of the methods given indicates that he is quite familiar with the subject. A considerable number of microscopic methods are given under qualitative reactions. The lack of a section on the analysis of commercial materials does detract in a small way, especially in view of the coverage given to this aspect of the topic in other volumes. The properties of thallium compounds in which the analyst may be interested are given in an appendix.

Analytical Chemistry of Uranium (Moscow, 1962), contains papers by various contributors, and the literature of the field is well covered. The work carried out in Russia is well documented and of considerable value. Chapter 4, on the determination of uranium, is the most important chapter in the book. As one would expect when several authors are responsible for a volume, the coverage is somewhat uneven. More space than appears warranted is given to polarography. In several instances the authors are noncritical. Certain rarely used procedures are given. Chapter 7, on the determination of impurities in uranium, is very spotty in its coverage and of somewhat questionable value. Considered as a whole, however, the monograph will be of considerable interest to the analytical chemist.

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British Ecological Society Monograph

Grazing in Terrestrial and Marine Environments. A symposium of the British Ecological Society, April 1962. D. J. Crisp, Ed. Blackwell, Oxford, England; Davis, Philadelphia, 1965. 338 pp. Illus. $12.50.

Like other symposia in the series, this one addresses itself mainly to fundamental aspects of practical problems. For future historians of science it thus provides a reflection of some of the concerns of the period and an assessment of the status of specific problems. For present-day readers the utility of different parts of the book will vary. Contributions range from one or two cursory progress reports, through detailed accounts of particular research efforts, to more general reviews. Coverage is broad, including such diverse phenomena as the effects of larger mammalian grazers on perennial plants and those of small invertebrate filter feeders on oceanic plankton. As must be expected, the variety of contributions results in something less than a satisfactory overview, and many aspects of grazing phenomena may have received less attention than they deserved. However, this is a natural consequence of this sort of effort. The comparisons and contrasts provided should, in any case, stimulate the many workers concerned with any of the aspects of grazing.

A short, unsigned introduction, which attempts to summarize the symposium as a whole, and the first paper, a review of the energetics of grazing (by Macfadyen), serve to integrate the other parts into which the volume is subdivided. Of these, the sections on grazing and range management and those on grazing by littoral and benthic organisms seem least successful in providing a coherent account of what is and what is not known. One feels that the efforts of various authors to be general have resulted in undesirable vagueness. But a group of four papers on grazing by sheep is particularly praiseworthy, for the individual contributions truly complement each other and document nicely a complex but reasonably well-understood set of interactions that may prove of considerable general interest.

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Applied Physics

Electron-Stream Interaction with Plasmas. Richard J. Briggs. M.I.T. Press, Cambridge, Mass., 1964. xii + 187 pp. Illus. $7.50.

An extensive effort has been made in recent years to investigate the interaction between streams of charged-particle beams and a plasma. The motivation has been, on the one hand, to understand and catalog unwanted instabilities and, on the other, to investigate the possibilities of generating and of heating a plasma. Some attempt has also been made to use these interactions for microwave amplifiers. The most active research has been done by the Russians, who are concerned with fusion, and by a number of groups in this country, who are concerned with somewhat more diverse objectives. Concepts and ideas from the field of microwave tubes have influenced much of the work in the United States, and the research activity of the group at Massachusetts Institute of Technology is among those which have been largely influenced by such concepts. The book under review, which is derived from the author's Ph.D. thesis, represents the general set of ideas associated with this group, particularly with the work of Bers, Haus, and Smullin. It is definitely a book for the specialist, but for his purpose it is valuable.

The long preliminary chapter is concerned with the set of criteria for distinguishing various kinds of instabilities, the so-called convective and nonconvective instabilities. These categories originated from the work of Sturrock and of Landau and Lifshitz, but very useful generalizations and extensions of these concepts, which have been made by the author and some of the other MIT workers, are described in detail in this chapter. Because the entire approach involves "pololology" and the general exploration of the complex plane, the discussion is necessarily largely mathematical. A partially successful attempt is made to provide some feeling for the physical aspects of the various criteria, but there is room for another attempt to provide physical plausibility. However, the chapter is probably the most complete treatment of this valuable approach, and extensions not available elsewere are described.

The succeeding chapters are concerned with applying some of these ideas on stability to investigations of various systems. They include sections on beam-plasma interactions in one-dimensional systems (in both cold and warm plasmas), transverse interactions, the effect of finite dimensions, and the interaction with ions in a hot electron plasma. There is a tendency to go from one case to another, write down the dispersion equation, derive the results, classify them with respect to the nature of their instabilities, and make perhaps too few comments about the physical aspects of each case. I did find that the practice of comparing some of the interactions to known microwave amplification mechanisms, such as the reactive wall and resistive wall amplifier, backward-wave amplifier, and the like, was useful and that it provided clarification for some cases which would otherwise be a little less comprehensible.

All in all, I think the book will be valuable as a reference source that, in a systematic and useful way, lists and classifies a majority of the interactions which can occur between streaming particles and a plasma.

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Annotated Problems in Physical Chemistry

Numerical Problems in Advanced Physical Chemistry. J. H. Wolfenden, R. E. Richards, and E. E. Richards, Oxford University Press, New York, ed. 2, 1964. xvi + 258 pp. Illus. $4.80.

The working of problems, usually requiring numerical answers, is justifiably regarded as an essential part of a college course in physical chemistry. Most college teachers rely on problems found at the ends of chapters in the textbooks that they use, often supplemented with their own collections of problems, home-grown or picked up here and there. Some local collections have given rise to published books that serve as additional sources for teachers and students. In addition to the volume reviewed here, these include Adamson's *Understanding Physical Chemistry* (Benjamin, 1964); Bareš, Černý, Fried, and Pick's *Collection of Problems in Physical Chemistry* (Pergamon, 1962); Guggenheim and Prue's *Physicochemical Calculations* (North-Holland, 1955); and Sillén, Lange, and Gabrielson's *Problems in Physical Chemistry* (Prentice-Hall, 1962).

The present book is a second edition, considerably revised and somewhat expanded. The problems contained in it are relatively few in number (144 with answers plus 15 short exercises without answers, compared with 400 to 700 problems in some of the other books mentioned), but they are high in quality, intellectual content, and research flavor. They are based on real (and often relatively raw) experimental data taken from important papers in the original literature. Most of them are annotated with additional remarks and references. The subject matter represents reasonably well the main areas of "classical" physical chemistry (equilibria, thermochemistry, solutions, electrochemistry) as well as modern developments in physical chemistry and chemical physics (chemical kinetics and photochemistry, spectroscopy and molecular structure, crystal structure, radiochemistry). The level is generally within reach of undergraduate introductory physical chemistry courses in the better institutions. The book should be well suited to honors or advanced undergraduate courses or graduate review courses. (In all of these respects the book resembles that by Guggenheim and Prue, except that the latter contains not problems but completely worked-out examples.) The problems are naturally somewhat harder, and take longer to work, than most problems placed at the ends of chapters in introductory textbooks, but these problems are a welcome contrast to the multitudes of the latter that are constructed with synthesized or hypothetical data, pruned of side issues and complicating factors, and somewhat out of touch with the real world of research and practice.

The book is decidedly Oxonian in flavor; all three authors are or were at Oxford. Not surprisingly, the name of C. Hinshelwood is mentioned in more problems than the name of any other person. The section on crystal structure, with seven problems, was contributed by D. Crowfoot Hodgkin, 1964 Nobel laureate in chemistry.

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Optical Masers. George Birnbaum. Academic Press, New York, 1964. xii + 306 pp. Illus. $9.50.

Like a well-known cigarette, the book *Optical Masers,* by George Birnbaum, might be described as a "treat" instead of a "treatment." Therein lies some of its strengths and some of its weaknesses.

True to the title and the author's intent, the book is concerned mainly with the physical principles and technology of optical masers or lasers and gives only fleeting attention to associated technology such as detectors and modulators and possible applications. The subject of nonlinear optics (optical mixing, harmonic generation, and scattering) is described with a detail that is on a par with the description of optical masers.

The organization of the book is extremely good, with the not unique arrangement of theory first and then experimental description. The book reads extremely smoothly, and the reader is carried forward at a pace somewhat uncharacteristic of a treatise. Examination of the author's style indicates how this is accomplished. The material is described in a fairly intuitive or physical way and the more detailed or rigorous treatment that can be found in the original literature is sketched very lightly.

It would be extremely unkind to characterize the book as merely an annotated bibliography, but to some extent it can be and was intended to be used that way, especially by someone active in the field. On the other hand, the reader new to the field can develop a quick but shallow appreciation of the fundamentals; the book was not intended to be, nor is it, a definitive treatise on the subject.

For my own taste the treatment of gaseous optical masers is somewhat meager and contains some erroneous statements. For example, the gain dependence on diameter of the discharge tube is generally attributed to the need to destroy certain metastable states of the atom by wall collisions. A more careful study of the literature would indicate that the metastable states are quite efficiently destroyed by electron collision and that the variation of electron temperature, and hence excitation rate, produces the dependence on diameter. Another lapse occurs in a paragraph on photography. The entire subject of holography, which is one of the more fascinating applications of laser technology, is discounted with the statement