length ranges from long waves through microwaves.

The text is only partially referenced in a bibliography of 243 items which are arranged in the order of their appearance in the text. This arrangement unfortunately makes the bibliography rather difficult to use.

The coverage of recent advances is rather spotty. For example, in the discussion of the use of satellite signals to measure electron density, no reference is made to the Faraday effect. Several papers on this subject were available as early as 1958, but they are not mentioned. One of the author's own references discusses the Faraday effect, although the topic is not mentioned in the text itself. Another omission is in the discussion of whistlers, which contains very little information beyond that available in Storey's 1953 paper. There is no mention of nose whistlers, although they represent an important advance in the field and were described in the available literature as early as 1956.

In the chapter on long waves, a calculation of field intensity in the earth-ionosphere waveguide, assuming a spherical earth, is outlined. The author's assumptions have been questioned by J. R. Wait in a recent review of a separate translation of this particular chapter (National Bureau of Standards, T5-60). To date there have been no responses to Wait's criticisms, and therefore the validity of the author's treatment remains in doubt.

Despite the limitations mentioned above, this book provides an impressive coverage of a rapidly growing field of research, and it is a valuable addition to the literature.

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Industrial Chemistry

Chemical Analysis: The Working Tools. vols. 1–3. C. R. N. Strouts, H. N. Wilson, and R. T. Parry-Jones, Eds. Oxford University Press, New York, ed. 2, 1962. vol. 1, 483 pp.; vol. 2, 489 pp.; vol. 3, 280 pp. Illus. $23.55.

Like the fleur-de-lis seal on a bottle of Bordeaux wine, the seal of Oxford University Press on a book bespeaks excellence and awakens anticipation. I was disappointed, therefore, when I opened volume 2 of this treatise and read (p. 4) that "The *p*H of this solution is *defined* as having the value 4 exactly at 15°C." Of course this is true, and the book does mention the indeterminacy of single-ion activities and cites the work of R. G. Bates. But one would expect the authors to provide at least an outline of the reasoning behind their choice of a *p*H scale. A greater disappointment is the account of overvoltage, 1930 vintage, in the chapter on electrodeposition. The chapter on chromatography (in volume 1) disclaims the intention of treating theory, but the theoretical plate concept, so essential to the intelligent use of elution chromatography, is barely mentioned, Glueckauf's distinguished work, which he has carried on since 1950, is not cited in the bibliography, and the paragraph about flow rates and elution volumes (p. 412) is, to put it mildly, misleading.

The field of chemical analysis has two aspects, practical and theoretical. Those of us who teach chemical analysis in universities like to make the subject intellectually respectable by emphasizing its fundamental principles, which range in an intriguing way from the thermodynamics of electrolytes through electrode kinetics to the theory of atomic and molecular spectra. Yet chemical analysis is essentially a utilitarian matter; principles are adapted to specific purposes, and when a better method is found the old one becomes obsolete. What was analytical chemistry today may not be so tomorrow. The academician is hard put to know which methods are actually being used and which are merely ingenious intellectual exercises.

Thus, *Chemical Analysis: The Working Tools* will be a boon to the teacher, for the three volumes describe the methods used in a very large industrial complex, Imperial Chemical Industries. It is a cooperative work by members of the Analytical Chemists' Committee of ICI, and it is a revised edition of a book published in 1955. Volume 1 treats sampling, weighing, precipitation, volumetric solutions, gas analysis, and fractional distillation, as well as chromatography, titration in nonaqueous solvents, isotope dilution, and vacuum fusion methods. Volume 2 deals with potentiometric and conductometric methods, electrolysis and coulometry, polarography, absorptiometric methods (in the visible, ultraviolet, and infrared), atomic absorption spectroscopy, emission spectroscopy, and x-ray methods. Volume 3 discusses organic analysis, including elemental and functional group analysis, and the determination of molecular weight.

Each method is richly illustrated by practical examples, most but not all of which are from the activities of ICI. These range from titanium metallurgy to insecticides and polymers. Instruments and equipment are described in detail, and the practicing analyst will note many ingenious and simple devices such as "bottled end points," or null-point reference electrodes for specific titrations. Yet there is no mention of the Schöniger combustion method!

In a cooperative work such as this some sections are always better than others. But among the really outstanding sections of this treatise are some that even a carping professor will enjoy—those on ultraviolet and infrared absorption spectroscopy and the painstakingly practical one on the standardization of volumetric solutions.

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Coherent Light

Lasers. Generation of light by stimulated emission. Bela A. Lengyel. Wiley, New York, 1962. xii + 125 pp. Illus. $6.95.

The current laser panic certainly justifies a publication intermediate in its sophistication between a review article and a textbook. I have only praise for Lengyel's monograph, which combines sound pedagogy with a competent technical review and references that the devotee as well as the initiate will find very useful. I think the book will be excellent for technically alert people who want to begin and do not know where to start. The research and review articles currently available do not have the appeal of a monograph that has an explicitly tutorial intent. Professionals who are active in the laser arena, or in fields of technology that are attempting to exploit the unique properties of these novel light sources, will certainly find many parts of Lengyel's work most helpful.

It would be easy to criticise this volume: questions could be raised, for example, about the development of some theoretical matters, about the

choice of topics in the more experimental adventures, or about the very pronounced emphasis placed on ruby devices. I am also sure many professionals will feel that more or less emphasis should have been placed on their work or on the efforts of others. However, I am far more impressed with the positive features of Lengyel's accomplishment than I am distressed by the inevitable deficiencies of a rapidly prepared book about an almost violently active topic. Lengyel has attempted to be useful to the reader, and he has achieved his purpose with considerable consistency throughout the exposition.

The main topic headings will give some idea of the scope of this monograph: Background Material on Radiation, General Description of Lasers, Solid State Lasers, Fluid State Lasers, Applications and Development. Many readers will benefit from the skill with which Lengyel has enfleshed this skeleton.

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Structural Information

Infrared Absorption Spectroscopy, Practical. Koji Nakanishi. Nankodo, Tokyo, Japan; Holden-Day, San Francisco, Calif., 1962. xii + 223 pp. Illus. $8.

This English-language edition of a text originally written and published for the Japanese market was published at the instigation of Carl Djerassi, who has provided an explanatory foreword. The book's title could be a bit misleading, since experimental aspects of infrared spectroscopy are rather briefly treated. Actually the book is intended for use as a guide in interpreting infrared spectra of complex organic molecules—that is, the problem of deducing structural information from the spectrum of an unknown substance. Its publication may cause some surprise, for two excellent and widely used sources of data are already available on the American market.

It is reasonable to inquire whether this is merely an updated and abbreviated Bellamy. The answer is unequivocally no. This is an excellent work in its own right. Nakanishi's systematic organization of the material is excellent and it brings an amazing wealth of information in easily accessible form to the user's fingertips. The references that follow each of the tables of data on a given functional group are up to date (1961) and well chosen.

A welcome innovation is the reproduction of the spectra of commonly employed solvents, and I was pleased to note that Young, DuVall, and Wright's overtone patterns for various aromatic substitution types are also reproduced. No other source provides such a display of accurate information in a format that is suitable for quick reference use. The average organic chemist will find a great deal of use for this part of the text.

There are novel features in Nakanishi's text that will greatly enhance its value to students of modern organic qualitative analysis courses and to graduate students beginning research work. A series of 85 problems that range over all uses of infrared spectral data in organic chemistry are presented. A major portion of the book (pages 71 to 223) is devoted to these problems and the detailed answers to them. Certainly this is the best way for a beginner to gain experience in interpreting infrared spectra. Each problem contains one or more spectral reproductions, an invaluable aid in learning about the shapes and intensities of the various bands. However, students must pay careful attention to the text interspersed among the tables, for only there (and in an exceedingly terse form) will they learn which bands are the more reliable sources of information. Perhaps only experience can teach that the appearance of bands in the spectrum at some given frequency is not always a guarantee of the listed function. Thus, the unwary will continue to interpret the bands at 910 and 990 cm^{-1} in 2-butanol as a vinyl group.

Credit must be given to the proofreader, since this book is quite free of misprints. I noted only one: a misprint in the table on page 20, which changed the C—H stretching vibration from 2925 to 1925 cm^{-1}. The spectra are well reproduced. The binding is of such poor quality that it is not likely to survive the handling this useful book will receive.

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Nuclear Chemistry

Basic Concepts of Nuclear Chemistry. Ralph T. Overman. Chapman and Hall, London; Reinhold, New York, 1963. xii + 116 pp. Illus. Paper, $1.95.

The author aims this monograph at the level of college undergraduates who have some scientific background; he also hopes to attract workers in other fields who lack training in nuclear chemistry and high school students who wish to add to their regular course material.

The mathematical complexity of the material is minimal, and the book may well be useful to high school students, for Overman's coverage of the field is more complete and systematic than that of other works directed toward high school students. For example, good discussions of interactions of radiation with matter, detection devices, and the often neglected errors and statistics are given. However, the book is written in conventional scientific style and will not excite the reader's imagination as successfully as those written in the Gamow style.

The author misses his other objectives. Bright freshmen can handle (and crave) more challenging material. Overman uses lengthy and confusing discussions to avoid simple mathematical expressions. For example, in treating statistical fluctuations, he shows a Gaussian distribution but omits the mathematical expression for it. There is not sufficient detail given to prepare workers in other fields for experiments involving radionuclides. (Overman's earlier books, written with H. W. Clark, excellently fulfils this aim.)

Space is often wasted when Overman introduces topics and then concludes that they are too lengthy or complicated to discuss. In the space required to write the simple Compton scattering relationship, we instead learn that "there are certain limiting values for the energies, especially when the scattering is at 90° and 180°." Overman gives a clever analogy between decay laws and water flowing from tanks, which is quite effective for parent-daughter relationships including secular equilibrium. But he fails to note the example of constant reactor production of a short-lived species. Then, in the discussion of activation analysis, $(1\text{-}e^{-\lambda t})$ is pulled from a hat.