citation spectra of atomic nuclei. This speculation has led to a new theory of nuclear structure, which is rich in physical content. Although this theory is based on the familiar shell model, it uses field theoretic methods new to nuclear structure and has developed a terminology all its own. Unfortunately, this has made the field difficult to study.

Now at last we have a treatment of the subject which should make it far more accessible to students. In this book Lane presupposes a knowledge of nuclear shell structure and some familiarity with field theory. With these tools the role of the pairing forces in producing an energy gap, and the subsequent effect on collective motions, is thoroughly investigated.

The text is presented in two parts, with separate bibliographies for each. The first part is devoted to explaining how the pairing force comes about, and then to comparing the results with the experimental features of nuclei. The second part develops the theory of the collective motion, with strong emphasis on the random phase approximation. Very little is said about the effect of long range (P_2) forces, and no time is devoted to Elliott's work on SU_3. The bibliography is excellent, and a few of the most significant papers are reprinted at the end of the book.

The book was prepared as a series of lectures delivered at Harwell in 1962. Like most volumes of lecture notes, it contains quite a few misprints. But these should merely tend to sharpen the attention of the careful reader, for they are not serious. Theoretical students and lecturers will find this book of great value. Experimentalists will probably want to skip a large number of theoretical sections that make frequent use of such sophisticated mathematical tools as Wick's theorem.

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Analytical Chemistry

Ionic Equilibrium. A mathematical approach. James Newton Butler. Addison-Wesley, Reading, Mass., 1964. xii + 547 pp. Illus. $8.75.

This is an amazingly good book. Butler has written clearly and brilliantly about a difficult subject, and it is obvious that he has thoroughly enjoyed doing so. The reader cannot help sharing his enthusiasm.

Right from the beginning the author declares his intention of unmasking the "hidden assumptions" common in analytical textbooks. He discusses complex equilibria and nonideality of electrolytes briefly in the first two chapters and in more detail later on. He presents the calculation of ionic equilibrium as an exercise in the art of mathematical approximation, and this theme runs through the book. First, of course, he states explicitly the conditions of mass balance, charge balance (or, as an alternative, the "proton condition"), and the free energy balances for the several equilibria and shows how exact equations for the hydrogen-ion concentration (and for other significant concentrations) can be derived. He then attacks the problem of solving high-order polynomials and explains Newton's approximation method as well as graphical and other methods. The most valuable method of all—"chemical intuition" followed by back-checking—is given the prominence that it deserves.

In chapter 5, on weak monoprotic acids and bases, there is a particularly good explanation of how approximations are made in practice. A logarithmic *p*H-concentration diagram illustrates the various approximations used to calculate the *p*H of a solution of a weak acid, and those concerned with *p*H-titration curves are carefully explained.

Logarithmic diagrams and semilogarithmic distribution curves are used to advantage throughout the book, and the discussion covers many different types of systems, including polyprotic acids, precipitation, complex-ion, and oxidation-reduction systems. The steepness of acid-base titration curves or "buffer index" is discussed in detail, and in this discussion the carping critic might recognize one trifling error—the equivalence point in titrating a weak acid with a strong base does *not* quite coincide with the point of maximum slope of the *p*H-titration curve, though the difference is negligibly small.

The author mentions many topics—among them the study of fast reactions by Max Eigen, Harned and Owen's measurements of ionization constants, Bates' study of *p*H scales, and Sillén's work on hydrolysis of metal ions. To some he gives more space than to others, but he always gives references; a distinctive feature of this book is the sentence or two of comment that accompanies every single reference cited—and there are many references. There are also many numerical problems, most of them having real practical interest.

The University of British Columbia lost an outstanding teacher when Butler decided to go into industry.

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Mathematics

Topics in Mathematics. 15 booklets: *Algorithms and Automatic Computing Machines* (112 pp.), B. A. Trakhtenbrot; *Areas and Logarithms* (56 pp.), A. I. Markushevich; *Computation of Areas of Oriented Figures* (64 pp.), A. M. Lopshits; *Configuration Theorems* (48 pp.), B. I. Argunov and L. A. Skornyakov; *Equivalent and Equidecomposable Figures* (80 pp.), V. G. Boltyanskii; *The Fibonacci Numbers* (56 pp.), N. N. Vorobyov; *How to Construct Graphs*, G. E. Shilov, and *Simplest Maxima and Minima Problems* (64 pp.), I. P. Natanson; *Hyperbolic Functions* (63 pp.), V. G. Shervatov; *Induction in Geometry* (112 pp.), L. I. Golovina and I. M. Yaglom; *An Introduction to the Theory of Games* (72 pp.), E. S. Venttsel'; *The Method of Mathematical Induction* (56 pp.), I. S. Sominskii; *Mistakes in Geometric Proofs* (64 pp.), Ya. S. Dubnov; *Proof in Geometry* (64 pp.), A. I. Fetisov; *Summation of Infinitely Small Quantities* (72 pp.), I. P. Natanson; *What Is Linear Programming?* (96 pp.), A. S. Barsov. Alfred L. Putnam and Izaak Wirszup, Eds. Published for Survey of Recent East European Mathematical Literature by Heath, Boston, 1963. $1.40 each.

These booklets were translated from the "Popular Lectures in Mathematics," a series of lectures delivered by well-known Russian mathematicians to groups of secondary school students in Leningrad, Moscow, and other Russian cities. The purposes of the booklets, which vary in size from about 50 to 120 pages, are ". . . to introduce the reader to various aspects of mathematical thought and to engage him in

mathematical activity of a kind that fosters habits leading to independent creative work."

The lectures deal with such topics as algorithms and automatic computing machines, configuration theorems, Fibonacci numbers, hyperbolic functions, geometrical proof, linear programming, and theory of games. Some provide elementary introductions to significant topics of these subjects, while others provide expositions of a greater depth than that usually found in standard textbooks. The booklets contain sequences of problems and their solutions, and for the most part each one is self contained.

The series is intended to reach a variety of readers in the United States, including secondary school students in the upper grades; teachers of mathematics and science in secondary schools, colleges, and universities; and students who are preparing to teach mathematics. Attempting to prepare reading material for such a varied audience is an extremely difficult task, and providing translations from Russian works would appear to be an even more difficult assignment. For the most part, *Topics in Mathematics* appears to have successfully accomplished these goals.

To secondary school students who have been exposed to the new curriculums in mathematics, the mathematical language may seem somewhat different or "old fashioned." Such usages as "unknowns" of an equation, function as a rule rather than a set of ordered pairs, and "equality" of sides of a triangle rather than "congruence" of sides are examples. But these are not serious detractions from the value of the booklets.

It is impossible to present mathematical material at a constant slope of difficulty, but at times in these lectures the ascent of difficulty seems unduly rapid, especially for secondary school students. For example, early in the lecture entitled *Areas and Logarithms* nearly a page is devoted to detailed instructions for locating a point on the Cartesian plane corresponding to a pair of coordinates, and only a page later a rather complicated outline of a method involving a passage to a limit to determine the area of a curvilinear trapezoid is presented. At other times the reader is asked to give proofs of theorems, when it is not entirely clear precisely what is available for his use.

In most of the volumes the topics are motivated extremely well by appealing to concrete problems before generalizations are attempted. For example, N. N. Vorobyov begins his discussion of Fibonacci numbers by presenting this interesting problem: "A pair of rabbits is placed in a walled enclosure to find out how many offspring this pair will produce in the course of a year if each pair of rabbits gives birth to a new pair each month starting with the second month of its life." In the next section, Vorobyov presents a general discussion of recursive sequences in which it is shown that the solution to the rabbit problem involves a recursive sequence.

I strongly recommend that *Topics in Mathematics* be added to secondary school and college mathematics libraries not only for their excellent mathematical content but for their cultural value as well. These booklets along with the volumes of the New Mathematical Library of the School Mathematics Study Group provide reading material on an interesting variety of topics by prominent mathematicians at an extremely reasonable cost.

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Standard Techniques

Handbook of Microwave Measurements. vols. 1–3. Max Sucher and Jerome Fox, Eds. Polytechnic Press, Brooklyn, N.Y., ed. 3, 1963 [order from Interscience (Wiley), New York]. 1216 pp. Illus. Set, $40.

As the title indicates, this three-volume work is intended largely as an instruction manual in microwave measurement techniques, in which principal emphasis is placed on methods of measurement and less emphasis on theoretical concepts. Presumably it will provide a sufficient description of most standard methods of measurement for an engineer or technician who is relatively uninformed in the field, but it will also provide a useful compendium of formulas and tables to serve as a handbook for those who are more sophisticated in the field. It does not aim to be a comprehensive text on microwave theory and therefore can hardly be faulted for any lack in this area. However, the value of such a handbook is enhanced if it provides more than a minimum amount of theoretical background, and in this respect the present edition represents a major improvement over the previous one. This is true of the entire book, but as an example, we might note chapter 4, on microwave linear networks. (This is not the title of the chapter, which is unnecessarily unwieldy.) This chapter treats its subject much more comprehensively than the second edition. Matrix notation has been incorporated, all the usual network representations are considered, and there is a more complete coverage of topics. Deschamps' work is included (his work was not considered in the second edition, even though his results had been published several years previously). Similar comments could be made about other chapters.

This more comprehensive coverage and more sophisticated treatment make the third edition of considerably greater interest to those of us who do not wish to learn the material from the handbook but who do wish to have a fairly complete reference volume.

There are certain omissions, for example, nothing on the measurement of periodic circuits, and very little on cavity perturbation techniques, which for certain applications are of great importance. The choice of topics, of course, is largely a result of the authors' own experience, particularly for more specialized techniques, and it is not likely that anyone would try to learn such specialized techniques from a handbook. For the more standard measurements, it is a satisfactory reference source.

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Organic Chemistry

Oxidation Mechanisms. Ross Stewart. Benjamin, New York, 1964. xi + 179 pp. $7.50.

Among the more common reactions in organic chemistry are those that involve oxidation and reduction, but despite their importance, very little work on the mechanistic pathways had been done prior to 1945. The publication of Westheimer's investigations on the chromic acid oxidation of isopropyl alcohol (in 1949) and the publication, at about the same time, of work on