a result, stress has been placed not only on purely chemical aspects of the subject, but also on physico-chemical, rheological, and structural principles underlying high polymers, their properties, and their applications.

The contents of the book may be judged from the chapter headings: 1. Introductory Definitions and Concepts; 2. Molecular Forces; 3. Some Special Behaviors and Properties of High Polymers; 4. Polymer Formation and Modification; 5. Structures of High Polymers; (6) Solubility and Molecular Weight Relations; 7. Rheology; 8. Molding and Manipulation; 9. Mechanical Properties; 10. Electrical, Thermal, and Optical Properties; 11. Fibers and Fibrous Products; 12 and 13. Rubbers; 14. Surface coatings; 15. Adhesive; 16. Resin Product Development. The book also includes an appendix section on high-polymer literature; properties of various fibers, plastics, and rubbers; adhesion, compatibility, and solubility of sundry materials of interest; and a table of chemical formulas and trade names of high polymers. The combined author and subject index covers 28 pages.

In their presentation the authors have treated briefly some topics which could stand fuller development, or have oversimplified the presentation in some instances for the sake of generalization. However, in a book of this type such a procedure is unavoidable. In the reviewer's opinion the authors have well attained their stated aims, and they have performed a real service in reducing to fundamentals the multitudinous aspects of high-polymer theory and practice. The book should prove well suited as a text for a good course in high-polymer principles, as well as a stimulating and valuable reference on the shelf of persons interested in high polymers.

The present volume has been published as part of the McGraw-Hill *Chemical Engineering Series*. The reviewer considers this classification misleading. Although it was written by teachers of chemical engineering, the book throughout reflects a broad and fundamental, rather than an engineering, approach to the subject, and it should have, therefore, a much wider field of interest than its classification would suggest.

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Diagnostic techniques for soils and crops: their value and use in estimating the fertility status of soils and nutritional requirements of crops. Herminie Broedel Kitchen. (Ed.) Washington 6, D. C.: American Potash Institute, 1948. Pp. xxiii + 308. (Illustrated.) $2.00.

This volume, sponsored by the American Potash Institute, consists of a historical introduction by Firman E. Bear and contributions by eleven other agricultural scientists, all assembled under the editorial guidance of Herminie Broedel Kitchen. It brings together the most recent methods for the testing of soils and plants for their content of several nutrient elements. Even though most of the material has previously been published in various journals, its assembly into a single volume represents a helpful service. It is testimony of increased attention to the possible chemical interactions by which soil nourishes plants.

The chemical methods for assessing soil fertility are clearly presented. These details will be very helpful to the student of soil chemistry and plant nutrition. The discussion of the correlation of soil tests with crop responses to fertilizer treatments, by R. H. Bray, is not only interesting but very enlightening. It accentuates the need for more information of this type, especially when commercial nitrogen and trace elements are moving into more general use. Such information is leading the agronomist, and anyone concerned with crop production, to look more to the soil in place, and not only to the crop and the soil in general.

The details of mass testing myriads of soil samples in a state or industrial laboratory appear less valuable. One is reminded that assembling data of multiplied cases on state dimensions has less virtue than educating individual farmers and county agricultural advisors by means of a few tests on specific soils whose history is a personal or lifetime experience.

The entire volume is well justified by the contribution discussing the testing of plant tissues in relation to their visual symptoms of malnutrition. This is excellent reference material. There is in this the starting point for diagnostic reasoning going from the visual symptoms of the growing plants to their deficiencies in nutrient chemical elements as parts in the plants' synthetic performances, and from there to their supply in readily exchangeable form in the soil.

The discussion of the biological assays of soil fertility omits those which have been superseded by rapid chemical methods. It develops new assays fitting the instances where chemistry is difficult or inadequate. Through the biological assays the symptoms of the plants are tabulated in greater detail in relation to the levels of nutrition as fertility of the soil. It is these symptoms that prompt their diagnosis as related to irregularities in the soil growing the crop.

The service this volume performs is its encouragement and help toward more careful observation of the plants as they reflect the nutritional services of the soil growing them. It will help to increase critical observations by the farmers themselves. The fact that enough differences in growth behavior of plants have been observed to challenge our diagnosis of the plants' physiological irregularities provoking them draws attention to the recent progress in both plant and soil sciences by which plant functions are causally connected with the chemical dynamics only recently elucidated for the soil. It is a gratifying record of these two sciences that soils and crops are becoming more closely linked in our understanding of plant growth as the creation of the living organic from the lifeless inorganic; it is also gratifying that a volume like this should help us view growth performances by the plant as those in which irregularities submit to diagnosis via procedures no different in principle from

those explaining the irregularities in physiology and nutrition of animals and man.

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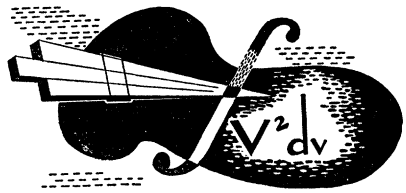

Rings and ideals. Neal H. McCoy. (Carus Mathematical Monographs of The Mathematical Association of America.) LaSalle, Ill.: Open Court Publ., 1948. Pp. xii + 216. $2.00.

This attractive little volume, well written and neatly printed, offers an excellent and almost entirely self-contained introduction to some of the most interesting topics in elementary modern algebra. Chapter I discusses the idea of a ring, with the help of some carefully thought out examples; chapter II further illustrates the same concept by a more detailed discussion of polynomial rings. Chapter III introduces the all-important notions of the ideal, of homomorphism, and of the residue class ring. After some auxiliary results in chapter IV, chapters V and VI offer an excellent, thoroughly modern, and lucid treatment, by means of Zorn's principle (without any finiteness assumptions), of the basic properties of the radical and of the Jacobson radical, and their application to the representation of rings as direct or subdirect sums. This is illustrated, in chapter VII, by a discussion of Boolean rings and of p-rings. The last two chapters (somewhat loosely connected with the rest of the book) give a concise exposition of matrices and determinants over arbitrary commutative rings (knowledge of the theory of determinants over a field being assumed), and of the basic facts concerning primary ideals and Noetherian rings.

Utmost simplicity has been reached in nearly all proofs; this, together with an easy and readable style, and a skillful use of examples, should put the book well within reach of beginners in the field, without rigor being sacrificed in any way to this object. Both the simplicity of the exposition and the generality of the results are further enhanced by the fact that the author carefully avoids bringing in any assumption before it really becomes necessary; when he does so, he takes into account the results of the latest research, including some of his own. Thus, chain-conditions are not even mentioned before the last chapter. Similarly, commutativity is introduced only when it is needed, even though the emphasis is mostly on commutative problems and methods. All this is in full agreement with the lastest developments in algebraic theory and practice, and should prove most helpful to readers who wish to acquaint themselves with such developments; further help and guidance is provided by means of a good bibliography and a brief discussion of the main source material at the end of each chapter.

The author deserves to be congratulated for this valuable addition to the literature; and the book may be warmly commended, both to newcomers to the subject and to those who have lost contact with it and may wish to bring their knowledge of its basic principles up to date.

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Introduction to applied mathematics. Francis D. Murnaghan. New York: John Wiley; London: Chapman & Hall, 1948. Pp. ix + 389. $5.00.

This is a time when applied mathematics is being cultivated very vigorously. Problems of gas dynamics, elasticity, atomic physics, and nonlinear mechanics, to name but a few fields, require the most powerful and advanced tools available to the mathematician, physicist, or engineer. Coincidentally, there is a need for books which will present in a clear, connected, and reasonably complete fashion the known facts about eigenvalue problems, partial differential equations, integral equations, calculus of variations, etc. Prof. Murnaghan, who has done outstanding work in applied mathematics, has drawn on his twenty years' experience in presenting such material to graduate students and has written a good and helpful introduction to the field.

The first two chapters are devoted to vectors and matrices. The treatment is vigorous and proceeds from the special to the general, a plan followed wherever possible throughout the book. Included are n-dimensional complex space and an introduction to the eigenvalue problem. Chapter 3, one of the most important, carries the discussion into function space; here the student will find orthonormal sets of functions, generalized Fourier expansions, and linear integral operators. Chapters 4 and 5 discuss curvilinear coordinates and Laplace's equation. Considerable attention is paid in the latter chapter to the useful "method of images." Chapter 6 discusses separation of variables for partial differential equations, power-series methods for ordinary differential equations, and special functions. In Chapter 7, the student will find self-adjoint linear differential operators, boundary conditions of various types, and a very complete discussion of Green's functions—including the central theorem concerning the equivalence of linear second-order boundary-value problems and Fredholm integral equations. Chapter 8 gives the theory of Fredholm integral equations and concludes with a careful discussion of Rayleigh's principle. Chapter 9 discusses the calculus of variations, with applications to dynamics. The last chapter is devoted to operational calculus, based on the unilateral Laplace transformation. The discussion is restricted to ordinary differential equations of general order and systems of such, but these are treated completely.

Altogether, the reviewer considers this a good though demanding introduction to applied mathematics. The word *introduction* is to be emphasized; in its 389 pages, the author has been forced to omit mention of several important topics, notably initial value problems. However, there are good discussions elsewhere of most of the omitted questions—while of the topics included, there are