

problems," runs a large risk that it will intensify such a feeling. On the other hand, books in which the exposition of the ideas reaches rather sophisticated levels, but in which the majority of the problems are either routine or unvaried (there are some) tend to invoke a "tempest in a teapot" reaction among students. Although the author does not so state, this book may have been written to supplement such texts; it appears that if used in that way the book may be worthwhile.

As its title implies, this book is almost entirely devoted to problems, either solved for the student or to be solved by him, with generous hints about solving the more difficult. The discussion (other than the explanations of the solutions), which the author tries to keep minimal, is also minimal in the information that it imparts to the reader. There is occasional use of the defensive clause "it is clear" and an off-hand way of making explanations—for example, the argument about why an additive constant appears in finding an antiderivative (p. 134).

The problems are generally well chosen. There are many routine exercises, some old standbys but also a variety of novel exercises touching on all the usual topics. A haphazard check of the problems indicates they are generally well stated, a few incompletely. However, for a problems book, it may also be a good exercise to pick out these.

As a reference and as a supplement to a good expository calculus book, this is to be recommended.

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## Carus Mathematical Series

**Combinatorial Mathematics.** Herbert John Ryser. Published for the Mathematical Association of America by Wiley, New York, 1963. xiv + 154 pp. Illus. \$4.

Although combinatorial mathematics is several centuries old, it has achieved a new appeal and prominence in the past quarter century, owing partly to developments within the field and partly to its growing importance with respect to cryptography, computer programming, information theory, operations analysis, the design of experi-

ments, and other subjects of scientific, industrial, or military significance. As the author observes, "Combinatorial mathematics cuts across the many subdivisions of mathematics, and this makes a formal definition difficult. But by and large, it is concerned with the study of the arrangement of elements into sets. . . . Two general types of problems appear. . . . In the first, the existence of the prescribed configuration is in doubt, and the study attempts to settle this issue. These we call existence problems. In the second, the existence of the configuration is known, and the study attempts to determine the number of configurations or the classification of these configurations according to type. These we call enumeration problems." (He might well have added "efficiency problems," in which the existence of the configuration is known and enumeration is unimportant, but in which the demand is for an efficient algorithm that will actually produce the desired configuration; such problems arise commonly in many applications of combinatorial mathematics.)

This polished and readable account of some fascinating aspects of the subject is devoted mainly to existence problems, including several basic, original contributions made by the author himself. A good indication of coverage is provided by the chapter headings: "Fundamentals of combinatorial mathematics" (16 pages); "The principle of inclusion and exclusion" (12); "Recurrence relations" (9); "A theorem of Ramsey" (9); "Systems of distinct representatives" (14); "Matrices of zeros and ones" (18); "Orthogonal Latin squares" (17); "Combinatorial designs" (35); "Perfect difference sets" (12).

Most of the material is "elementary" in the sense that its understanding does not require an extensive mathematical background. Nevertheless, the subject is justly known for its difficulty, and Ryser is to be congratulated for his clear presentation. The exposition is supplemented by a good index and an appropriate bibliography for each chapter. An attractive feature is the mention of various interesting unsolved problems, in which the field abounds. As the author concludes in his preface: "Combinatorial mathematics is tremendously alive at this moment, and we believe that its greatest truths are still to be revealed."

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## Geochemistry

**Earth Science and Meteoritics.** Compiled by J. Geiss and E. D. Goldberg. North-Holland, Amsterdam; Interscience (Wiley), New York, 1963. xvi + 312 pp. Illus. \$10.50.

The variety in this collection of 15 articles is an admirable tribute to the versatility, wide interests, and stimulating personality of Fritz Houtermans, professor of physics in the University of Berne. The articles cover a number of topics of great current interest and research activity, and the list of authors is a guarantee of careful and judicious treatment. The extreme variety of the topics, however, may militate against the wide circulation this book deserves, since most people, other than specialists in radiochemistry and isotope geochemistry, are likely to find their interest limited to one or a few of the articles. The book would be useful collateral reading for graduate courses in geochemistry.

The articles are "Early history of the Earth" (30 pp.), by W. M. Elsasser; "Radioactive heat production in eclogite and some ultramafic rocks" (12 pp.), by G. R. Tilton and G. W. Reed; "Some recent researches on lead isotope abundances" (29 pp.), by R. D. Russell; "The concentration of common lead in sea water" (15 pp.), by M. Tatsumoto and C. C. Patterson; "Rates of sediment accumulation in the Indian Ocean" (12 pp.), by E. D. Goldberg and M. Koide; "The natural distribution of radiocarbon: Mixing rates in the sea and residence times of carbon and water" (12 pp.), by H. Craig; "On the investigations of geophysical processes using cosmic ray produced radioactivity" (26 pp.), by D. Lal; "Neutrons in meteorites" (24 pp.), by P. Eberhardt, J. Geiss, and H. Lutz; "The tritium content of atmospheric hydrogen and atmospheric methane" (17 pp.), by F. Begemann; "Tritium in rainwater" (17 pp.), by H. v. Buttlar; "Cosmic ray produced  $\text{Na}^{22}$  and  $\text{Al}^{26}$  activities in chondrites" (11 pp.), by M. M. Biswas, C. Mayer-Böricke, and W. Gentner; "Isotopic and chemical composition of some terrestrial natural gases" (21 pp.), by G. J. Wasserburg, E. Mazor, and R. E. Zartman; "Rare gases in the sun, in the atmosphere, and in meteorites" (30 pp.), by P. Signer and H. E. Suess; "The half-life of  $^{187}\text{Re}$ " (7 pp.), by B. Hirt, G. R. Tilton, W. Herr, and W. Hoffmeister;