

drocarbon rearrangement and carbonium ion polymerization. It thus represents a thorough coverage of a wide variety of reactions proceeding through carbonium ion intermediates.

As might be expected in a volume that contains chapters written by many different authors, a few chapters are in conspicuous contrast to the majority, which are thoroughly done and well presented. It is somewhat regrettable that the poorest chapter is that on the classical example of the Friedel-Crafts reaction, the condensation of alkyl halides with aromatics.

The book is well printed, largely free of errors, and deserves to be on the reference shelf of any chemist interested in acid-catalyzed reactions proceeding through carbonium ion intermediates.

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## Mathematical Recreations

### Mathematical Games and Pastimes.

A. P. Domoryad. Translated from the Russian edition (Moscow, 1961) by Halina Moss. Pergamon, London; Macmillan, New York 1964. xii + 298 pp. Illus. \$5.

This book was written as a source-book for games, contests, and extra-curricular activities in Russian schools. It includes a great variety of problems, puzzles, number tricks, games, and geometric constructions. Some of the material is already available in other publications, but many of the ideas and mathematical analyses are original. In explaining the mathematical basis for the recreations, Domoryad uses a multitude of mathematical ideas most of which relate to algebra, geometry, or number theory.

The first few chapters deal with system of numeration and topics in number theory. This is followed by arithmetical tricks, puzzles, and shortcuts. Next, winning moves in such games as Nim, Fifteen, chess, dominoes, and magic squares are analyzed. Geometric constructions such as regular polygons and polyhedra, parquets, borders, symmetry, curves, moebius strips, networks, and maps are treated, and some attention is given to cutting and reassembling geometric figures, to the construction of pleasing patterns, and to paper folding. The final sections in-

clude a variety of classical problems and puzzles.

The activities presented apply mathematical ideas to an amazing variety of situations. Hence, the book may be used to search for original solutions to unusual problems and theorems. Although some problems are fully analyzed, only references to solutions are provided for others, and unfortunately most of the sources cited are not available in the United States. At the end of the book answers are given for some problems; for others, questions and hints are given to help the reader discover the solution. However, it is very difficult to locate answers to specific problems, because no reference numbers are used.

Since the book was originally published in Russian and was translated by an Englishwoman, many symbols, algorithms, and terms will be strange to Americans. For example, in long division, the divisor is written to the right of the dividend and the quotient below the divisor. A three-digit numeral is expressed as  $\overline{a\ b\ c}$ , and improper fractions are called "vulgar fractions." The layout, with little variation in format or organization, no color, and no numbered paragraphs for easy reference, gives the book the appearance of a college textbook rather than a book intended for recreational use. The abbreviated proofs, extensive use of symbols, and technical language will make the book enjoyable to the sophisticated reader but may discourage the immature student.

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## Geology of Africa

**Geological Map of Africa.** Prepared by UNESCO and the Association for African Geological Surveys. UNESCO, Paris, 1964 (available from UNESCO Publications Center, New York). 9 sheets and *Explanatory Note* (39 pages). Set, \$55.

This spectacular new map covers all of Africa and Madagascar, as well as Saudi Arabia and adjoining parts of the Middle East. It is at once a magnificent base from which to develop the subsurface resources of a continent and a monument of international scientific collaboration. It was compiled by the Association of African Geo-

logical Surveys, under the direction of Jean Lombard, on Belgian and French base maps, printed by an Italian firm with UNESCO support, and follows the conventions of the Commission for the Geological Map of the World of the International Geological Congress. Each sheet is an independent unit—sheets 1 to 6, 8, and 9 include their own explanation, while sheet 7 is a more detailed explanation for the entirety. A fuller explanation, summary, and geographically arranged list of sources are provided in the accompanying *Explanatory Note* by Raymond Furon and Jean Lombard, outstanding French students of African geology. The text and explanation are in both English and French. Geographic names and features but no political boundaries are shown. The inclusion of the insular geology and bathymetry of the surrounding oceans enhances the usefulness of this map.

Those familiar with the map of Africa which was prepared by the same association, and published in pieces between 1938 and 1952 by the Bureau d'Études Géologiques et Minières Coloniales in Paris, may well wonder why a new map so soon. Actually the new map represents the same sort of advance over the map published between 1938 and 1952 as the 1957 map of the U.S.S.R. represents over that published in 1937. Intensive postwar geological reconnaissance covering nearly all of Africa is here summarized. Indeed, no other continent has had so comprehensive and detailed an assessment of its substructure at so early a stage in its economic development.

Striking features of the geology of Africa brought out by this map are the prevalence of Precambrian rocks and of continental deposits of all ages. Some 57 percent of the total surface of the continent is underlain by Precambrian, at many places the host-rock for deposits of copper, iron, manganese, gold, and uranium. Continental deposits are abundant from Precambrian to Recent—tillites and associated sediments referred to as the Basal Continental; the so-called Nubian sandstones of Cambrian to Middle Cretaceous age; the red beds, tillites, coal measures, basalts, and the like of the Karroo Series; the "Continental intercalaire," mainly Mesozoic, with plants and dinosaurs; and the fossiliferous "Continental terminal," spanning the Tertiary. Quaternary beds of continental facies are also widespread, including the desert sands of the north

and the laterites that cover immense areas of the intertropics. Marine deposits of Cambrian through Lower Carboniferous age are widespread in the Sahara and Atlas regions, but, with the exception of a brief Saharan invasion by the Cenomanian sea, Africa has been essentially emergent for the last quarter billion years.

Apart from granites of metamorphic or intrusive origin, endogenous rocks are represented by the West African dolerites of probable Triassic age, thick basaltic fissure extrusions that terminated the Karroo sequence in Triassic time, extensive basaltic and silicic lavas of probably mainly Tertiary age in East Africa, carbonatites at a number of places, and the "Great Dike" of Southern Rhodesia which has an outcrop more than 300 miles (480 km) long and 3 to 4 miles (4.8 to 6.4 km) wide, on the same alignment as the rift valleys and Madagascar.

The tectonic picture is the least satisfactory, as might be expected when such a map is based primarily on reconnaissance mapping. The compilers inform us that the original documents were so heterogeneous with respect to structural data that only those faults were retained "which mark an abnormal contact or constitute a lineament." Smaller structures like the Vredefort Ring almost vanish at this scale. Except in the Atlas Mountains and parts of the Sahara, Madagascar, the Rift Valleys, and the Middle East, little structural grain is apparent. Rather we see a number of granitic or Precambrian centers or continental basins separated by overlying or bounding rocks like plums in a pudding. Furon and Lombard warn that "circumspection is recommended when applying to Africa the preconceived notions derived from studies made in other parts of the world."

The difficulty of compiling from heterogeneous sources inevitably shows up in small particulars like the meridional "fault" at 20° East and the tropic of Capricorn. Inevitably, in a couple of decades, there will be a new and better map, but this map at this time excites only admiration. The distributors have with all propriety characterized it as "A milestone in African research." It is also a challenge and a reason to hope for the future mineral economy of Africa. And it should be mentioned that it is, in addition, an achievement in pure cartography—the registration is perfect, and although the compilers were a little stingy with sym-

bolic lettering, the color discrimination is so good that most isolated unlettered patches can be identified without trouble.

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## Organic Chemistry

**Chemistry and Technology of Explosives.** vol. 1. Tadeusz Urbański. Translated from the Polish by Irena Jeczalikowa and Sylvia Laverton. Pergamon, London; Macmillan, New York, 1964. xvi + 635 pp. Illus. \$15.

This is the first volume of the English-language edition of Tadeusz Urbański's three-volume work; it is an expanded and revised version of the editions published in Polish (1953–1954), in Czech (1958–1959), and currently being published in German. The author has undertaken the monumental task of reviewing and summarizing the entire literature on the synthesis, manufacture, and chemical properties of explosives and related compounds. The result is far more encyclopedic than might be inferred from the title.

Volume 1 traces, with more than 1400 literature citations, the scientific and technological development of carbon-nitro compounds, only a few of which have been utilized in quantity production of explosives. Nearly a fourth of the volume is devoted to nitration processes, and the survey of the early literature provides an interesting study of the development of organic chemistry. It is refreshing to be reminded that picric acid was prepared by the action of nitric acid on indigo (Waulfe, 1771), or that nitrogen was recognized as the linking atom in carbon-nitro compounds because their reduction yielded amines, while reading about electrophilic substitution, molecular orbitals, infrared and x-ray spectra, and nuclear magnetic resonance. For those more particularly interested in explosives, volume 1 includes a broad survey of the physical and chemical properties of commercial and military explosives. The toxicity of aromatic nitro compounds and related problems of industrial hygiene are especially well treated. Numerous production processes are described; unfortunately many of them date from

World War I or were those used only in Japan and Germany during World War II. The treatment of aliphatic nitro compounds is overly brief, particularly in view of the prominence accorded polynitro-aliphatic compounds in the recent literature. Many of the explosive properties reported date from pre-World War I and are described in outmoded terms. For example, ammonium picrate is "more powerful" than TNT because of a higher detonation rate.

The organization of the volume occasionally results in repetitious discussion, because nitration processes, general properties, specific compounds, and manufacture are treated in separate chapters. Despite these minor criticisms and a number of typographical errors, this book makes a worthwhile contribution; the translation is excellent, and complete author and subject indices greatly enhance the value of the book. One looks forward with interest to volumes 2 and 3, which promise to cover the other classes of explosive compounds and explosive compositions—and even to provide a brief treatment of rocket fuels.

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## New Books

### Biological and Medical Sciences

**Agricultural Genetics.** James L. Brewbaker. Prentice-Hall, Englewood Cliffs, N.J., 1964. 170 pp. Illus. Paper, \$2.95; cloth, \$4.95.

**Allgemeine Cytologie.** Eine Einführung in die funktionelle Morphologie der Zelle. Ekkehard Grundmann. Thieme, Stuttgart, Germany, 1964. 435 pp. Illus. DM. 59.70.

**Analytical Methods for Pesticides, Plant Growth Regulators, and Food Additives.** vol. 2, *Insecticides* (637 pp., \$23); vol. 3, *Fungicides, Nematocides and Soil Fungicides, Rodenticides, and Food and Feed Additives* (251 pp., \$12). Academic Press, New York, 1964. Illus.

**Animal and Clinical Pharmacologic Techniques in Drug Evaluation.** John H. Nodine and Peter E. Siegler, Eds. Year Book Medical Publishers, Chicago, 1964. 680 pp. Illus. \$18.

**Animal Behavior.** Its evolutionary and neurological basis. V. G. Dethier and Eliot Stellar. Prentice-Hall, Englewood Cliffs, N.J., ed. 2, 1964. 128 pp. Illus. Paper, \$1.75; cloth, \$3.95.

**Animal Physiology.** Knut Schmidt-Nielsen. Prentice-Hall, Englewood Cliffs, N.J., ed. 2, 1964. 128 pp. Illus. Paper, \$1.75; cloth, \$3.95.

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