Pure and Applied Mathematics Series

Geometry of Manifolds. Richard L. Bishop and Richard J. Crittenden. Academic Press, New York, 1964. xii + 273 pp. Illus. $10.50.

The Geometry of Manifolds is a textbook intended for use in second-year graduate courses on the fundamentals of modern differential geometry. The authors assume a knowledge of real variable theory, linear algebra, and point set topology, but none of geometry. Their principal interest seems to be Riemannian geometry, but along the way all the main concepts of differential geometry are introduced: manifolds, Lie groups, fiber bundles, exterior forms, connections, and affine connections.

This is a great quantity of preliminary material, which can only be worked in by not going too deeply into any of it. Definitions are given, theorems stated, many examples worked and problems posed, but the proofs of the main theorems are sketched or omitted, references to the literature being inserted to fill the gap. In the final chapters, on Riemannian geometry, full proofs are given, and all the important ideas and theorems are discussed (including such a recent result as the Rauch comparison theorem) except the Gauss-Bonnet theorem. The latter omission is in line with a general policy not to introduce any concepts from algebraic topology.

The strongest point of this book, and the one that distinguishes it most sharply from other recent books on global differential geometry, is the wealth of examples and problems that are included. These are a great aid to understanding and provide flexibility for instructors using the volume as a textbook. The shortage of proofs in the early part is something of a handicap, because instructors may prefer to use the lecture time for other things and leave the proofs to be read. Nonetheless, this book is worth serious consideration for use as a textbook and as part of a mathematician's library.

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Chemistry of Functional Groups: An Advanced Treatise

The Chemistry of Alkenes. Saul Patai, Ed. Interscience (Wiley), New York, 1964. x + 1315 pp. Illus. $37.

This is volume 1 in a projected series of advanced treatises on the chemistry of functional groups. Only once is there duplication of authors among the 14 chapters, but the editor's guidance seems evident because the style is reasonably uniform.

The book's aim "is to present an up-to-date dissertation on the chemistry of the carbon-carbon double bond [the C=C bond] in all its aspects" and to emphasize "the C=C bond as a functional group." Its scope indeed is broad. Treatment of topics is full without being encyclopedic. Discussions are generally critical, with emphasis on mechanistic considerations.

The first 148 pages are devoted to a chapter entitled "Wave mechanics and the alkene bond" by C. A. Coulson and E. T. Stewart. Succeeding chapters are "Elimination reactions in solution" (W. H. Saunders, Jr.), "Olefin-forming eliminations in the gas phase" (Allan Maccoll), "Alkene-forming condensation reactions" (T. I. Crowell), "Detection and determination of alkenes" (E. J. Kuchar), "Alkene-complexes of some transition metals" (Michael Cais), "Alkene rearrangements" (Kenneth Mackenzie), "Nucleophilic attacks on carbon-carbon double bonds" (S. Patai and Zvi Rappoport), "Reactions of alkenes with radicals and carbenes" (J. I. G. Cadogan and M. J. Perkins), "Allylic reactions" (R. H. DeWolfe and W. G. Young), "Cycloaddition reactions" (the longest chapter, 216 pp., by R. Huisgen, R. Graskey, and J. Sauer), "Conjugated dienes" (M. Cais), "Cumulenes" (Herbert Fischer), and "Ketenes" (the late R. N. Lacey). Each chapter is indexed, and the entire book is also indexed.

The content, clearly, is much broader than "alkenes." The International Union of Pure and Applied Chemistry's rules of nomenclature stipulate *alkene* as the generic name for "unsaturated, unbranched acyclic hydrocarbons having one double bond"; *alkadiene*, for two double bonds; and so on. Kuchar's chapter alone adhered to this limitation. Thus, representative of compounds discussed elsewhere in the book are such substances as butadiene, tetraphenylbutadiene, styrene, cyclohexene, acetylene, methylene, cyclopentadiene, cinnamic acid, cholestene, β-nitrostyrene, cycloheptatriene, azulene, stilbene, ethyl maleate, carotenoids, retinene, allylamine, tricyanoethylene, acrylic ester, allyl chloride, and allene. All contain the C=C bond but none is an alkene. Some other examples even excluded the C=C bond—trimerization of nitriles or isocyanates (p. 743), the formation of 1,3,4-oxadiazoles from 2-acyltetrazoles (p. 747), or the dimerization of piperideine *N*-oxide (p. 752). Hence, the book title is too restricted. Another title, "The Chemistry of the Carbon-Carbon Double Bond," for example, would have been better. The scope includes radicals, carbanions, carbonium intermediates, Diels-Alder additions, phosphorus compounds, a variety of pyrolytic processes, ferrocenes, methylenes, arynes, sydnones, ketenes, and enough other topics to provide a broad education for any reader.

The nomenclature is fairly good, but one shudders at seeing "isobutene," "*t*-butanol," "isopropanol," "acetate ester," "2-pentyl," and "phenylisocyanate" as frequently as they appear. Certain omissions might have been helpfully included: (p. 485) under nucleophilic attacks on acrylonitrile, an example [*J. Am. Chem. Soc.* **81**, 2430 (1959)] to show that the carbanion acquired by acrylonitrile may react further without adding a proton; (p. 398) rearrangement of maleic into fumaric acid on fusion [*J. Org. Chem.* **2**, 314 (1937)]; (pp. 454, 705, and 724) rearrangement of *N*-allylaniline salt into *o*-allylaniline [*ibid.* **22**, 1418 (1957)]; (p. 893) the modified Diels-Alder reaction of anthracene and 1-nitronaphthalene [*J. Am. Chem. Soc.* **77**, 601 (1955)]; (p. 1124) the thermally produced propadienyl-propargyl radical [*ibid.* **84**, 4509 (1962)]; and, although too recent, (p. 190) the difference between *t*-BuO$^-$ towards RCH_2CH_2Br (elimination) and RCH_2CH_2OTs (substitution) [*ibid.* **86**, 3072, 5711 (1964)].

The wealth of material included and the general excellence of presentation make this an important addition to the chemical literature. Those who own it will refer to the volume frequently. A deterrent against ownership is its cost, but even the price is more reasonable than that of some recent, comparable volumes. The book is recommended enthusiastically.

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