MAGNETOCHEMISTRY

Magnetism in Relation to Chemical Problems

By Dr. K. N. Mathur. (Lucknow University Studies, No. 8.) Pp. vi + 185. (Lucknow: Lucknow University, 1940.)

MAGNETOCHEMISTRY is a branch of chemical physics in which interest has re-awakened of recent years. In no small measure has this been due to the considerable output and variety of work by Indian workers, and more particularly by Sir Shanti S. Bhatnagar and his collaborators. Bhatnagar has not only initiated, directed, and obviously inspired work in this field, but also he collaborated, in 1935, with the author of the monograph under review in writing "Physical Principles and Applications of Magnetochemistry". Several other texts have been published within the last decade, but there is still a large number of physical chemists (or is it, nowadays, chemical physicists ?) who would welcome a compact, clear, and concise account of what may be called post-Pascal magnetochemistry.

The present volume was written to fulfil this need. The first nineteen pages introduce the subject and deal with various methods of measuring magnetic susceptibility. A discussion of diamagnetism follows and occupies seventy pages. Langevin's theory of diamagnetism and van Vleck's quantum-mechanical theory are reviewed. Ionic susceptibilities, their evaluation by various means from experimental data and their calculation, are discussed, but it is questionable if so much space should have been given to Fajans's theories of deformation of ions. The additivity of diamagnetism and constitutive correction factors are next discussed and lead to applications of diamagnetism in valency problems, in liquid mixtures, addition compounds, polymerization, and in solid solutions and mixtures.

Paramagnetism is dealt with in fifty-seven pages (pp. 91–147) under the following headings : Langevin's theory, intrinsic molecular field, paramagnetism and quantum theory, paramagnetic substances and the influence of temperature and crystalline fields on them, iron group and complex salts, including a discussion, rather extended for the size of the monograph, on general theories of valency. A short chapter of six pages on magnetism in relation to chemical equilibria completes the subject-matter.

Then follow thirty-two pages of references, indexes, and advertisement of other works in the same series ; this seems to be an unduly large proportion of space to devote to these matters, particularly as only one reference, out of the 144 given, refers to work published after 1937. Much interesting work has been published since then, and its non-inclusion is one serious defect in the monograph. Unfortunately, there are others. The proof reading has been very badly done, with the result that typographical errors are frequent ; for example, "sudstances", "struture", "alipahtic", "invarient", "hysterisis", "principle quantum number". Much more irritating, and serious, are errors in mathematical expressions, confusion of symbols, omission of integration limits, and incorrect signs.

While the printing is clear and the format convenient, the style is variable and often careless. The frequent omission of the definite or indefinite article jolts the reader. So also does the use of "analysis" as a plural noun and of "maxima" and "minima" usually, but not always, as singular nouns (*vide* p. 87, which bristles with examples). Ungainly constructions need not necessarily convey wrong meanings, but several which do might be quoted from the monograph ; one must suffice : on p. 23 we read "*In case* [my italics] the atom possesses an initial magnetic moment the small value of the diamagnetic susceptibility may be entirely masked. . . ." Finally, the reviewer feels that he will not be alone in wishing that the statement on p. 12, that water is "easily obtainable in a pure form" were, in fact, really true.

Workers in the field of magnetochemistry will find this book insufficiently up-to-date ; to recommend it to students would be inadvisable, if not dangerous.

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TOPOLOGY

Lectures in Topology

The University of Michigan Conference of 1940. Edited by Raymond L. Wilder and William L. Ayres. Pp. vii + 316. (Ann Arbor, Mich. : University of Michigan Press ; London : Oxford University Press, 1941.) 3 dollars.

THERE is an amazing difference of opinion concerning the importance of topology. Some claim that it is a new type of mathematical thinking, which goes to the heart of qualitative spacial relations, makes complicated analysis intuitively simple, throws light on differential and functional equations, opens a new era in dynamics, and is applicable to problems of electric circuits and of the constitution of chemical compounds. Yet others regard it as a highly specialized subject which can be safely ignored even by geometers, and point out that topologists have not yet solved the apparently elementary four-colour map problem which has been discussed for more than a century.

Topology, formerly called *Analysis Situs*, is the theory of such properties of geometrical figures as are unaltered by stretching or bending (without tearing or joining). From this point of view a sphere is equivalent to an ellipsoid, but differs from an anchor ring. The fundamental problem is to find the invariants. One of the oldest results is the Descartes-Euler relation between V, E, F, the number of vertices, edges, and faces respectively of a polyhedron, namely, $V - E + F = 2$. Instead of a polyhedron, we may take V points on an ellipsoid, and by joining them up in pairs by E arcs divide the surface into F polygonal areas. Then $V - E + F$ is a topological invariant called the *characteristic* and has again the value 2. If we replace the ellipsoid by an (unbounded) surface of *genus* p, for example, a sphere with p holes through it, we get $2 - 2p$. Surfaces may also be classified as *orientable*, if a positive sense of rotation can be assigned consistently at all points, or *unorientable*, and for topological equivalence two surfaces must agree in this respect as well as in characteristic.

However, experts regard all this as merely the infancy of topology. The whole outlook was changed by Poincaré (from 1895), whose definitions and methods, particularly those involving matrices, are fundamental in the modern treatment. His work was n-dimensional and highly abstract, and later writers have still further refined it by introducing the postulational treatment of abstract spaces and the theory of aggregates. The contributions of L. E. J. Brouwer (from 1911) are of great importance. For the last twenty years, topological research has been