

BOOK REVIEWS

Gruppentheorie und Quantenmechanik. HERMANN WEYL. Second Edition. Pp. 358. S. Hirzel, Leipzig, 1931. Price, bound, RM 26.

The quantum theory has made it desirable for physicists to become acquainted with mathematical subjects of which heretofore they were allowed to remain blissfully ignorant. This mathematical apparatus is related on the one hand to partial differential equations (Schroedinger's wave-mechanics) and on the other to the theory of Hermitean quadratic forms and unitary transformations (statistical interpretation). In the third place the quantum theory makes use of the noncombining properties of term systems in the solution of special problems as well as in the familiar justification of the exclusion principle. An attempt has also been made by Dirac to introduce a symbolism having no direct relation to our number system (q numbers) which yields the numerical results necessary for physical applications only in the final stage of the symbolic operations.

For the physicist interested in the most direct experimental implications of the quantum theory the interrelations between these fields of pure mathematics are of little interest. The main parts of the subject may be presented in a small amount of printed space as has been done by Heisenberg in *The Physical Principles of the Quantum Theory*. Elementary developments of the noncombining properties of angular momenta and the related intensity relations are well known and the symmetry properties of electronic proper functions are easily handled in most practical cases by Slater's method. From a certain point of view a deeper study of the mathematical landscape seems, therefore, superfluous.

The transformation theory of classical dynamics is perhaps also superfluous in the same sense and the theory of Maxwell-Faraday stresses could be subjected to the same criticism. The engineer has little occasion to refer to either and for the same psychological reason many physicists approach the study of the more fundamental mathematical aspects of quantum theory with a certain amount of disdain. This fact does not affect however either the beauty or the usefulness of these subjects and in fact an elegant application of Weyl's presentation of the group of rotations has been made by Kramers in a recent paper on intensity formulas.

In Weyl's book the quantum mechanics is presented from the point of view of a mathematician and so far as the reviewer is able to judge in the best taste and with the most powerful machinery. The interrelations between the different aspects of the same mathematical problem are kept in mind throughout. As indicated by the title the guiding principle is that the matrices representing physical quantities define transformations which are representations of certain abstract groups. Operations with abstract groups correspond to the q number calculus. The contents of the first edition have been amplified by the addition of a discussion of the Heisenberg-Pauli wave field theory. The fifth chapter dealing with the group of permutations has been rewritten in a much more elementary form. The connection of the symmetric group with the group of homogeneous linear transformations has been kept in the foreground. Dirac's treatment of permutations as dynamical variables falls in naturally with the methods used here. This is a convenient place for reference to formulas and derivations for group characters of the symmetric group.

Throughout the book many pertinent mathematical subjects have been treated in an elegant and efficient manner. As an example section 3 of Chapter II devoted to spherical harmonics gives in three pages all the necessary material. The treatment of Dirac's relativistic equations is also very good and thorough. The reading of the book is greatly facilitated by a list of symbols used which has been added in the new edition. Contents: I. Unitary geometry II. Physical principles and simple problems of quantum theory. III. Groups and their representations. IV. Applications of groups to angular momenta, Dirac's relativistic equations, the wave field theory, V. The symmetric group.

G. BREIT

Henley's 20th Century Book of Recipes, Formulas and Processes. Edited by HIRSCOX. Pp. 809, Norman W. Henley Publishing Co., New York, 1930. Price \$4.00.

This book, as the title indicates, gives many recipes and formulas which may be of value to the laboratory technician or the home shop-worker. The material, taken from various lines of industry and craftsmanship, is alphabetically arranged throughout the book, with a supplementary index at the end which is a help where there is more than one popular nomenclature for the subject matter under inquiry. The printing is good and the type of a size easy to follow.

I believe the book is better suited for the amateur home worker than it is for the professional laboratory man who has at least a meager idea of what the industrial and scientific library holds in the way of literature along the various lines. Material from the trades is necessarily brief giving more of an outline than a workable procedure for the novice. For the research worker who is at a standstill for want of information on technical manipulation, the book may yield an inspiration for a new attempt. The latitude of the material might be a boon under such circumstances.

WM. B. HALIDAY

Atlas of Physical and Inorganic Chemistry. A. VON ANTROPOFF AND M. VON STACKELBERG. 29 charts and descriptive volume 64 pp. Verlag Chemie, G.m.b.H. Berlin 1929. Price RM 42.00.

The atlas consists of 29 charts (11 x 14.25 inches) printed on stiff card board, accompanied by a descriptive volume of the same size. The plates show the material in the form of histograms or columnar diagram. The following physical and chemical quantities are represented: (1) The periodic table. (2) The electron shells of the atoms. (3) Atomic diameters. (4) Ionic diameters. (5) Ionization potentials. (6) The crystal structure of the elements. (7) Melting and boiling points of the elements. (8) Mechanical properties of the elements in the solid state. (9) Atomic frequencies of the elements. (10) The atomic force constant. (11) Specific and atomic electrical conductivities. (12) Valencies of the elements. (13) Normal electrode potentials. (14) Heats of combustion. (15) Melting and boiling points of the chlorides and the electrical conductivities in the fused state. (16) Hydrides. (17) Carbides. (18) Nitrides. (19) Solubilities of hydroxides, carbonates, sulphates, chlorides, sulfides and a few other salts. (20) Isotopes. (21) The geochemical distribution of the elements. (22) The occurrence of the elements in the earth's crust and in the whole earth.

The printed volume which supplements the charts gives in every case a short discussion and the necessary definitions of the topics illustrated in the diagrams. It seems to the reviewer that the atlas is, on the one hand, too large for convenient desk use and on the other hand too small for the use with large classes. It should find its principal use with small seminar groups where a few individuals need the material as a basis for discussion.

GEORGE GLOCKLER

Les Quanta. G. DÉJARDIN. Pp. 224. Armand Colin, Paris, 1930. Price 10f.50 unbound.

Within its appointed scope as an elementary exposition of the conceptions and fundamental experiments underlying the quantum theory, this book seems for the most part quite successful. Short chapters on radiation theory and specific heats present the basic ideas of the Planck radiation formula and the Einstein-Debye theory of specific heats of solids. Chapters on the photoelectric effect and x-rays give the salient features of the Auger effect, the angular distribution of photo-electrons, the absorption of x-rays, and the Compton effect. Considerable space is devoted to a discussion of classical mechanics, Bohr's atomic theory and correspondence principle, Sommerfeld's fine structure formula and similar topics from pre-quantum mechanics atomic physics. After a short chapter on thermionics, photochemistry and Raman effect the book closes with a few pages on wave mechanics. The explanations seem uniformly clear and the material well chosen. The reviewer, however, doubts the efficacy or the need of retaining the older theoretical explanations even in elementary treatments such as this one, for in many respects the conceptions associated with the newer theory are distinctly simpler than their progenitors, and besides, once learned they will not need to be unlearned for at least some time to come.

E. L. HILL