

Books Received

Investigations on the Theory of the Brownian Movement. By Albert Einstein. (Dover Publications, N.Y.), 1956. Pp. 119. Price \$1.25.

Currents in Biochemical Research. Edited by David E. Green. (Interscience Pub.), 1956. Pp. xvi + 697. Price \$10.00.

Anatomy of the Honey Bee. By R. E. Snodgrass. (Cornell University Press, New York), 1956. Pp. xiv + 334. Price \$6.00.

History of Analytic Geometry. By Carl B. Boyer. (Scripta Mathematica, New York 33, N.Y.), 1956. Pp. ix + 291. Price \$6.00.

Mechanical Testing and Inspection of Engineering Materials. By J. H. Lamble. (Cleaver-Hume Press, Ltd., London), 1956. Pp. 460-98. Price 3 sh. 6 d.

Report of the Rothamsted Experimental Station for 1955. (Harpenden Rothamsted Experimental Station, Harpenden, Herts.), 1956. Pp. 255. Price 8 sh. 6 d.

CHEMICAL APPLICATIONS OF SPECTROSCOPY*

THE present volume is a very valuable and welcome addition to the series publication—"Technique of Organic Chemistry", edited by Dr. Arnold Weissberger. Like its predecessors, it is a collaborative work containing contributions from well-known experts in the respective fields.

Applications of various physical methods for the study of organic compounds have now become a routine procedure in all laboratories. In many of these methods the experimental data are easily interpreted and can be effectively utilised in the solution of chemical problems with very little of theoretical knowledge. But the case is slightly different as regards the applications of spectroscopic methods in organic chemistry. It is easy to accumulate data on the absorption spectra of organic compounds both in the ultra-violet and infra-red regions, but it is difficult to interpret them. A knowledge of the theory of spectra is essential before one could interpret the data successfully. In the present volume on the chemical applications of spectroscopy, the emphasis is therefore on the theoretical aspect. It serves as an introduction to the interpretation of the spectra of organic compounds.

The book is divided into six chapters. Most of the chapters deal with the theory of spectra and the interpretation of experimental observations. The spectral region covered extends from microwave to ultra-violet radiations. Only brief descriptions of the experimental procedures have been given, but these are supplemented by a comprehensive list of references to original papers.

Chapter I on "Introductory Survey of Molecular Spectra" has been written by Dr. W. West. It contains an account of the spectroscopic units and nomenclature and the general features of the spectra of atoms and diatomic molecules. It also contains a brief survey of the quantum mechanical description of the electronic states and the methods of atomic and molecular orbitals. This introductory chapter forms an excellent basis for understanding the spectra of more complicated molecules dealt with in the subsequent chapters.

The second chapter on microwave and radio-frequency spectroscopy has been contributed by Prof. Walter Gordy, who is a well-known authority in the field. This subject covering the spectral region from about 1 mm., bordering on the long-wave infra-red region, up to those of the familiar radio waves, has come into prominence since World War II. The development of practical methods in this branch of spectroscopy in recent years has contributed powerful tools for the study of structure of matter, beside X-rays and electron diffraction. Their potentialities as a powerful method for chemical analysis have not yet been fully exploited. Prof. Gordy gives a lucid exposition of several important aspects, such as nuclear quadrupole coupling and its relation to chemical binding, nuclear magnetic resonance and the application of microwave spectroscopy, to the analysis of substances of great biological importance such as phthalocyanine, chlorophyll, haemoglobin, proteins and amino acids.

In Chapter III, Prof. A. B. F. Duncan presents the theory of infra-red and Raman spectra of polyatomic molecules. Group theoretical methods which are increasingly applied to the problem of molecular vibrations, their selection rules and intensities have been described and illustrated with appropriate examples.

* *Chemical Applications of Spectroscopy—Technique of Organic Chemistry*, Vol. IX. Editor: W. West. (Interscience Publishers), 1956. Pp. xxiv + 787. Price \$15.00.

The next chapter by Drs. R. N. Jones and C. Sandorfy is on the applications of infra-red and Raman spectrometry to the elucidation of molecular structure. This chapter is the longest in the volume, reflecting the current interest of organic chemists in infra-red spectra. The most important contribution is the comparative study of the frequencies characteristic of specific groups of atoms in a number of organic molecules, which appear in the infra-red and Raman spectra. All available data have been collected, analysed, and presented in the form of tables and figures. A detailed discussion of the characteristic group frequencies has also been included. In recent years the emphasis has been on the importance of accurate measurements of intensity in the infra-red region. The authors have therefore included in this chapter a comprehensive analysis of the ideal and of the experimental conditions appropriate to such measurements.

Chapter V on the electronic spectra in the visible and ultra-violet regions consists of two parts. The first part written by Prof. A. B. F. Duncan on the theoretical aspects embodies a comprehensive treatment of the atomic and molecular orbital theories of the electronic states of molecules. The second part by Prof. F. A. Matsen contains a detailed description of the three main structural components of electronic spectra, viz., the single bond, the multiple bond and the basis group and the effects due to substitution, hyperconjugation, etc., on these. A number of general topics connected with electronic spectra such as complexes, effect of change of state, colouring matters and dyes have also been discussed.

The last chapter on fluorescence and phos-

phorescence contributed by Dr. West contains a summary of the general features of these phenomena as observed in organic substances. The relation between rigidity, planarity, ring-closure, etc., and fluorescence has been illustrated by choosing a number of examples. An excellent discussion is also given on the explanation of Lewis and Kasha that the phosphorescent emission is due to triplet-singlet transitions and its intensity is governed by spin orbital interaction. The quantum yield of phosphorescence and the triplet levels and thermochromism are also briefly discussed.

The book thus covers practically the whole field of spectroscopy from the millimetre wave to the far ultra-violet. The theories are presented in a simple manner so as to be easily understood by non-mathematical chemists and the chapters dealing with the interpretation of data contain a number of tables and illustrative diagrams.

The principal symbols used in the book which number well over two hundred and fifty have been tabulated and presented along with their definitions under the heading "Symbol Index" at the beginning of the book. This will be very helpful to the reader. There is also the usual subject index at the end of the book. The absence of author index is rather disappointing.

This book should find a place not only in every organic chemistry laboratory but also in every laboratory where work on problems of chemical physics is carried on.

Considering the wide range of topics discussed and that too in great detail the cost of the book does not seem to be high.

R. S. KRISHNAN.

SCIENCE NOTES AND NEWS

Tandem Vande Graaff Generator

A new type of particle accelerator for study in continuous detail of the nuclear energy levels of heavy elements will be installed by Atomic Energy of Canada Limited at Chalk River early in 1958.

The new machine consists of two specially designed Van de Graaff generators placed end to end in a horizontal position, giving the accelerator an overall length of 34 ft. and a diameter of 8 ft. The 35-ton accelerator will be mounted on a rail in an L-shaped building, 150 ft. long and 60 ft. wide. The building now

under construction at Chalk River is located against a hillside so that the ground on one side will act as the shielding against high-energy radiation. Thick concrete walls will shield other sides of the building. A separate building will house controls and services.

The beam of high-speed particles produced by the tandem accelerator will be focussed and deflected in a series of powerful electromagnets into an experimental area 25 ft. from the accelerators. The machine will be equipped with a switching magnet that will make it possible to shift the particle beam into any one of five