

REVIEWS

Cosmic Rays. By R. A. Millikan. (Cambridge University Press, London), 1939. Pp. 134. Price 8s. 6d.

This book is based on the lectures delivered by Prof. Millikan at Virginia in 1936 and at Dublin in 1937. The material, however, has been brought up to the date of publication in 1939. Though it deals largely with the work done by the cosmic ray group at the Norman Bridge Laboratory in Pasadena, the important conclusions arising out of the work of other schools are also considered.

The first few pages of the book are devoted to answering also the question "What are cosmic rays good for?", and incidentally also to some comments on world-affairs not wholly unconnected with the subject of the book. An excellent historical treatment of the growth of knowledge about electromagnetic radiation then follows. Starting from the earliest work of Gockel, Hess and Kolhorster, Professor Millikan gives a lucid account, not only of the subsequent results but also the reasoning by which they were reached. And in this treatment the frankness of the author is refreshing, specially with regard to his own work on the world survey of cosmic ray intensities. One can see evidence in almost every page of the rare experimental skill and unlimited perseverance of Prof. Millikan. His description of the Neher electroscope is a fine example of how closely the growth of knowledge in this field has been the result of new experimental techniques.

The various geomagnetic effects have been qualitatively treated and the conclusions that can be drawn from the experimental results about the primary cosmic ray spectrum, the nature of the particles and their probable origin have also been mentioned as far as our present knowledge permits. The cloud-chamber technique for photographing and measuring the energies of the cosmic ray particles has been described, and an account is given of the discovery of the positron. A non-mathematical treatment of the various processes of energy loss of charged particles traversing matter is given, as also a description of the cascade theory of shower production. In the text,

this theory is attributed to Bethe and Heitler; actually, however, it was the paper of Bhabha and Heitler (1937) which first explained showers by a successive application of the phenomenon of Bremsstrahlung and pair creation. It might also be mentioned that statement 7 on page 54 might suggest that this process of shower production continues 'until the energy is all degraded into a very large number of lower and lower energy photons and electrons'. Actually, the loss by ionisation becomes the more important as soon as the energy falls below a critical amount depending on the nature of the matter traversed. (For air, this is about 1.3×10^8 electron volts.)

The treatment of the meson component of the cosmic radiation in this book is rather inadequate. This was, however, inevitable as this part of the subject has been quite a recent development. C. V. RAMAN.

Annual Review of Physiology. By James Murray Luck and Victor E. Hull. (American Physiological Society and Annual Reviews Inc., California), 1939. Pp. v + 705. Price \$5.00.

This is a new and welcome publication which has undertaken the difficult and responsible task of surveying the year's advances in the field of physiology. The success of such an enterprise depends upon the extent of willing co-operation of the foremost workers in the field, which the editors of the Review would be able to elicit and in the present instance, we may feel confident that under the editorship of Dr. Luck, who has a genius for organising such publications, these annual reviews will have a long and brilliant career of sustained excellence and usefulness.

The present volume covers practically every aspect of physiology; the energetics of physiological processes, the functioning of the vital organs and the tissues of the body and the physiology of the special senses, and the endocrine glands are all included. The volume has reviews on the progress of applied physiology and psychology. The field covered by the publication is thus wide and comprehensive.

We share with the editors the hope that "this new review will supplement the invaluable service which has been rendered for many years by *Physiological Reviews* and the *Ergibnisse der Physiologie*". The Annual Review is proposed to serve a somewhat different object; to give a broad resume of the significant work in the entire domain of physiology.

The Annual Review, by the very nature and variety of topics discussed, will attract the attention of a wide circle of scientific workers and we have every hope that this new venture will be crowned with the same degree of success which has attended the *Annual Review of Biochemistry*. M. S.

Chemicals of Commerce. By F. D. Snell and C. T. Snell. (Chapman & Hall, Ltd., London), 1940. Pp. viii + 540. Price 28sh.

This book is a useful descriptive compilation of classified commercial products of common or relatively common use though I rather doubt the suitability of calling many of them, e.g., rubber, petroleum, etc., "chemicals". The field covered is wide but a comprehensive selection has been made and arranged in thirty-eight chapters, each of which deals with a different group of commercial substances, the individual specification of which is preceded by a general outline of the characteristic properties of the group.

In general, the book appears to me to be more particularly suited to the American reader, as U.S.A. standards, particularly U.S.A. pharmacopeial standards, are so frequently mentioned and the definition of proof strength is not that used in Great Britain or India, but there can be no doubt of its utility to the chemical profession.

I appreciated some sections of the book more than others and, in particular, the chapters giving information on Extracts of Natural Products, Essential Oils, Perfumes and similar classes, of which the authors seem to have a specialised knowledge and provide much information which it is frequently difficult to find. The arrangement of the items in these chapters as also in the tables given on pages 316-17, 428-29 and elsewhere could be improved while from that excellent feature, Appendix B, which 'translates' medical terms used in the text, I missed cathartic, choleric, excipient, genitouri-

nary, laxative, nutrient, sternative and styptic.

In some instances, the information given does not appear to be quite up to date. For example, there is no mention of liquid hydrofluoric acid, buna, sulphurised oils, perchloron, maxchlor or power alcohol while the identity of teesol, agdite, pontol and hydronol might have been very useful to advisory chemists in any country experiencing difficulty in the matter of denaturants for alcohol, and a chapter on commercial solvents with their trade names, such as Westron, Westrosol, Dekalin, would have been welcome and a wider selection of new synthetic drugs would have appealed to certain classes of chemists.

I found it difficult to reconcile myself to such loose statements as the description of the ternary azeotropic mixture of alcohol, benzene and water, as a compound; chromium as both acidic and basic in its properties and the statement that no water is formed in the reaction of acetic anhydride with cellulose. Among technical errors observed were the value of ammonium nitrate in explosives, the action of carbon on barium sulphate and the definition of mortar.

The paper and printing are excellent though the splitting of words in the form, potas-sium, hy-droxide, hydrol-ysis, pred-ict and neces-sary, strike one strangely. There are singularly few spelling mistakes but I would invite attention to cocoa for Coca and propionic for propiolic and a few similar errors which might cause difficulties. Among the few incorrect formulas may be mentioned BaOH , $8\text{H}_2\text{O}$, the sodium molybdates and tungstates, orpiment which is As_2S_3 , not As_2S_2 , $(\text{CH}_3)_2\text{C}_6\text{H}_4\text{OH}$, $\text{NH}_2\text{C}_6\text{H}_4\text{NHOCC}_6\text{H}_5$ and $\text{HOC}_6\text{H}_4(\text{NO}_2)\text{Cl}$. Much repetition could have been avoided by a general statement to the effect that *o*-, *m*-, *p*- meant ortho, meta and para and α and β , alpha and beta. In some cases, the orientation of cyclic compounds is indicated and omitted in others, e.g., T.N.T. and sodium picramate. I doubt if morpholine can be described as structurally similar to ethylene diamine.

As similar chemical dictionaries have appeared recently, I examined this work with great care but, although I have made rather a detailed criticism, it must not be concluded that there is not much of value in the work, including a considerable amount of newly classified information. It

seems to me, however, that the authors appear to have attempted rather too much in the compass of a single book and I feel that, in future editions, an expansion of each chapter and the addition of new ones will be found necessary until the work ultimately has to appear in several volumes.

My view, therefore, is that "Chemicals of Commerce" will prove valuable to professional chemists rather as an addition to the shelves of their libraries than as a comprehensive book of reference summarising the type of information suggested in its title.

H. B. DUNNICLIFF.

Phenomena at the Temperature of Liquid Helium. By E. F. Burton, H. Grayson Smith and J. O. Wilhelm. (Reinhold Publishing Corporation, New York; Chapman & Hall, Ltd., London), 1940, Pp. xi + 362. Price \$6.00.

In this book written for the American Chemical Society, Professor Burton and his colleagues of the McLennan low temperature laboratory of the University of Toronto give us a survey of all the work done at low temperatures till April 1939. The book is divided into eleven chapters. Four chapters are devoted to the low temperature technique, to explain how these low temperatures are produced and the method employed in measuring them. For a time, some theoretical calculations raised serious doubts whether the extreme low temperatures recorded (0.005° Curie) in adiabatic demagnetisation experiments were really attained. The mathematicians calculated on certain assumptions the probability for the transition of a quantum of magnetic energy into a quantum of thermal energy. This probability gives the time taken by the magnetic ions to be in equilibrium with the temperature of the crystal lattice. Fortunately for the experimenter he was able to determine these times experimentally and thus succeeded in showing that the calculations are wrong by a multiplying factor which is of the order of one thousand, and that the low temperatures recorded are really attained.

Four more chapters are devoted to describe the interesting phenomena of superconductivity and the peculiar properties of liquid helium. From the entropy temperature diagram between 0° and 4° K it is inferred that in the superconducting

state the electrons contribute to the entropy as if they were the atoms of a solid, that is, as if they were reduced to an ordered configuration, and it is suggested that this order would probably be a regular distribution of velocities rather than a regular arrangement in position. The remaining chapters deal with our present ideas about the thermal and electrical conductivities, about magnetism and about specific heats. These we believe are included to make the book complete in itself and are presented in a way which is different from the routine and is yet original and simple. For example, the authors make a clear distinction between the contributions to the specific heat, of atomic and molecular vibrations (Debye), of atomic and molecular excitation (Schottky), of co-operative phenomena (Bragg-Williams and Bethe), and of conduction electrons in a metal (Sommerfeld).

The theoretical part of the book will be intelligible to anybody familiar with the principles of thermodynamics and of elementary quantum theory. There is also an exhaustive bibliography with about 700 references. The book can be read with advantage as an introduction to low temperature physics.

K. R. DIXIE.

Calculations of Quantitative Analysis. By Carl J. Engelder. (John Wiley & Sons, New York; Chapman & Hall, Ltd., London), 1939. Pp. vi + 174. Price 12sh.

In an exact science like analytical chemistry, the theoretical principles and concepts can be reduced to mathematical terms, and hence the calculations involved in applying theory to practice constitute a very essential part of the study of quantitative analysis. The book under reference aims at covering and supplementing the usual course of elementary quantitative analysis with a set of graded problems. There are fifteen sets of twenty problems each, with correct final answers supplied for alternate problems only, this latter in order that the student can check for himself the correctness of his method of solution of problems. Each set of problems is preceded by a concise account of the theory and a few typical calculations.

The book is divided into four parts. Part I deals with introductory considerations, arithmetical operations and reagents in general. Part II which covers nearly half of the

book deals with calculations in volumetric analysis, including acidimetry and alkali-metry, volumetric precipitation analysis, and oxidation-reduction processes. Part III takes up the calculations involved in gravimetric technique, and Part IV concludes with the applications that are made of analytical data obtained by either volumetric or gravimetric methods.

Both teachers and students will find the book a helpful companion for the B.Sc. course.

C. R. V.

Spectroscopy and Its Applications. *Proceedings of the Seventh Summer Conference on Spectroscopy and its Applications*, held at the Massachusetts Institute of Technology, Cambridge, Massachusetts, July 17-19, 1939. (John Wiley & Sons, Inc., New York; Chapman & Hall, Ltd., London), 1940. Pp. viii + 154. Price 16sh. 6d. net.

In this book we have a number of papers (twenty-eight to be exact) contributed by various authors to the Seventh Summer Conference of Spectroscopy and its Applications, called together by Prof. G. R. Harrison and held at the Massachusetts Institute of Technology. The papers deal mostly with the ever-widening field of application of spectroscopic methods. The extraordinary range of applications will best be appreciated by perusing the "alphabet of spectroscopy" given on pp. 7-9 of the book. There are papers dealing with the speed and accuracy of routine analyses carried out in several industries, e.g., steel analysis at the Ford Company, analysis of ceramic materials, estimation of small traces of elements in fertilizers, determination of lead in blood and so on. Other papers deal with the sources, the dispersing instruments and the apparatus for the measurement of intensities, which is at the basis of quantitative spectrochemical analysis. Biological applications are covered by a number of papers and there is one paper on astrophysical applications. Although the several papers are not logically connected, and do not give a detailed survey of all the methods employed and results obtained, one can get a fair idea of the problems that are being tackled and

the methods that are being developed, at first-hand. One could have wished for more details in certain instances and if it had been possible to include a summary of the discussions which the papers evoked, this wish would have been partly fulfilled. However, we must be grateful to Prof. Harrison for making the results of such congresses of specialists available to a much wider public. Here in India, some of the developing industries will profit materially by adopting spectrochemical methods of analysis and we should warmly recommend the book to those in authority in these industries. For the ordinary physicist, we are afraid, the price is too heavy, considering the extremely minute chance he has of obtaining any emoluments from professional consultations. But a perusal of the book will certainly correct the biased view that much of modern physics taught at the Universities is a mere high-brow disquisition about atoms and quanta, without any fields of useful application.

T. S. S.

Mathematical Tables, No. 1. (Statistical Laboratory, Calcutta), 1940. Pp. 30. Price Rs. 2.

These tables contain the values of n^r (for $r = 2, 3, 4, \frac{1}{2}, -\frac{1}{2}, -1$) and of $\log_{10} n$ from $n = 1$ to 1000. The values of $n^{\frac{1}{2}}, n^{-\frac{1}{2}}$ and $\log n$ are given to 7 places but those of n^{-1} are given to 9 places. The natural and logarithmic sines, cosines and tangents of angles from 0° to 90° are also tabulated to 7 places, at intervals of $0^\circ \cdot 1$. The inclusion of a table of values (to 5 decimal places) of e^x from $x = 1$ to 300 at intervals of $\cdot 01$ is a useful feature. The figures in the last line of each page are repeated again in the first line of the next page; this duplication appears to be superfluous.

Though much of the material in this first number of these tables is easily available elsewhere, in conjunction with the further numbers yet to come and of which presumably the present number is the forerunner, these tables are sure to be of good use to all who have to deal with numerical data. The printing and get-up of the book are quite good.

V. R. T.