Book Reviews

Low Temperature Techniques

Cryogenics. Marshall Sittig. Van Nostrand, Princeton, N.J., 1963. x + 221 pp. Illus. $6.75.

Cryogenic Engineering. J. H. Bell, Jr. Prentice-Hall, Englewood Cliffs, N.J., 1963. xiv + 411 pp. Illus. $16.

These books are intended by their authors to fill two quite different functions in the literature that deals with the rapidly expanding application of low temperature techniques in industry and technology. *Cryogenics*, by Sittig, ". . . is directed to the biologist, the chemist, the electrical engineer or just the inquiring reader who finds here a connection with his or her interests and is tempted to explore the cold frontier." *Cryogenic Engineering*, by Bell, ". . . has been prepared for students who are taking courses in Cryogenic Engineering, and also as a working source book for practicing cryogenic engineers."

Sittig's *Cryogenics* is divided into 19 chapters. The first eight ("The really new frontier," "How cold is produced," "The great names in cold," "Where cold is studied," "How cold is measured," and so on) constitute a descriptive survey of the history and techniques of low temperature technology. The remainder is an uncritical survey of areas in industry and technology where low temperatures are applied directly, or of areas where some material that has been produced through cryogenic techniques is used. The book is written at the level of a popular science magazine and is quite readable. A considerable amount of statistical information related to the production and to the consumption of products is presented (data which may well soon be obsolete, for this is a rapidly developing area of technology).

With respect to its stated objective, the work suffers from the inadequacy (frequently the total lack) of its explanation of the fundamental principles involved in various apparatuses or processes for which illustrations or diagrams are given. Even more objectionable are the errors of fact and the misimpressions that are created. The "inquiring reader" might well conclude that the Joule-Thomson liquefier was in use shortly after 1853 (the experiments of Joule and Thomson), whereas more than 40 years elapsed before von Linde *discovered* the practical significance of the Joule-Thomson effect *when combined with the counter flow heat exchanger* for the production of low temperatures. Debye and Giauque did not share a Nobel Prize. Debye's was awarded in 1936, Giauque's in 1949. In each case the award was made for many other fundamental contributions in addition to their work on the principles of adiabatic demagnetization. Liquid hydrogen is approximately 1/14, not approximately 1/4, as dense as water. Helium ions formed in the field emission microscope are *not* ". . . accelerated by the magnetic field. . . ." And there are many more. Unfortunately, there is no bibliography to which the reader can refer for authoritative discussion of a particular topic.

I hope the author and publisher will correct the errors, for an authoritative survey written at this level is certainly needed. As it stands, Sittig's book can be recommended only to the "inquiring reader" who is satisfied with an uncritical general survey and who does not require a volume that is accurate in detail.

Although *Cryogenic Engineering*, by Bell, was prepared as a textbook for students and as a sourcebook for practicing cryogenic engineers its treatment of the underlying fundamentals of cryogenics is elementary and very superficial. Bell suggests that the book's use ". . . should be preceded, paralleled or followed by good courses in thermodynamics or heat transfer." It is doubtful that a student in a good course in thermodynamics or heat transfer will find any use for a book which contains statements like the following: "The Joule-Thomson cooling phenomenon that occurs when a gas is expanded at constant entropy gradually lowers the temperature until liquid begins to form in the receiver," and ". . . ortho hydrogen at 200 atmospheres will convert to para hydrogen in about 24 hours at room temperature." The utility of the various examples and problems is seriously impaired by the prevalence of arithmetical (or typographical) errors in the solutions and by the very extensive use of unidentified outside sources of information.

The extensive technical data given in the text and in appendixes A, B, and C have a high potential value, but this is compromised by Bell's failure to include units (and even captions) for the coordinates of some graphs, by grossly erroneous entries and garbled table headings, and by the failure to identify the original sources of the data. Extreme examples are Figs. 4.15, 6.2, and A-21 where families of 8, 6, and 8 curves, respectively, are presented without the values of the parameters that characterize the individual curves being given at any place in the text or on the figures. It is difficult to identify an audience to whom this work can be recommended without serious reservations.

D. N. LYON
Low Temperature Laboratory, University of California, Berkeley

Nuclear Models

Contemporary Models of the Atomic Nucleus. P. E. Nemirovskii. Translated from the Russian edition (Moscow, 1960) by S. Nikolic and M. Nikolic. Bernard T. Feld, Ed. Pergamon, London; Macmillan, New York, 1963. xii + 332 pp. Illus. $15.

There are several useful purposes for a book on nuclear models, and it is probably not possible to satisfy all of them in one book. There could be a book for those who are on the fringe of the subject but would like to know more about recent developments. Another could outline the formal theoretical treatment and the way in which approximations are made. A third could serve as a text for those in the field of nuclear physics. This book serves the first of these purposes; it may also partially serve the third, but I am no longer in the field of nuclear physics and cannot easily tell.

There has been a great advance in

the understanding of nuclear physics since the publication, 10 years ago, of Blatt and Weisskopf's authoritative book, which satisfied all three of the above purposes. Unfortunately very few books on this topic have been published since then, so I find this one particularly welcome. There is almost no overlap between this book and Blatt and Weisskopf, so that the author is enabled to concentrate on the newer developments. For example, all discussion of the two-body forces (by now a field large enough to spawn a monograph or two on its own) is omitted.

The first chapter, a discussion of the experimental data now available and of the basic theory underlying the derivation, ranges from the nuclear size measurements by electron scattering to magnetic moment measurements. Almost all of this is new material that has become available in the last 10 years. I would have hoped here for a tabular summary of the numbers available, or in cases where the data are too extensive, for a reference to other tabular data. This I find is not as complete as desirable.

In chapters 2, 3, and 4 the author discusses in turn the shell model, the collective model, and the optical model. I find the discussion in each case quite clear; one could again perhaps wish for more references to alternative, and in many cases more thorough and detailed, discussion of the topics.

Chapter 5 returns to the shell model and, in particular, radiative transitions are considered.

In discussions with Russian physicists I notice occasional resentment of the fact that foreign (particularly American) authors ignore their work. One may make the inverse complaint here. Because the majority of the work in nuclear physics since the war has been in America and Western Europe, no Russian book of any use at all can ignore this work completely. But in this volume Russian references are often used in preference to original Western work. For example, the scattering of neutrons by a coulomb field (through the medium of the magnetic moment) was authoritatively predicted in America and experimentally confirmed in Western Europe; yet the author refers solely to a less complete Russian paper.

These failings are minor; I find the book readable and useful, and I am glad to have it on my bookshelves.

RICHARD WILSON
Department of Physics,
Harvard University

Chemical Technology

Infrared Band Handbook. Herman A. Szymanski, Ed. Plenum Press, New York, 1963. xii + 484 pp. Illus. $35.

The *Infrared Band Handbook* is really a collection of bands listed by position in wave numbers. According to the publisher, more than 8500 bands are listed, and by my count these derive from about 1100 compounds. The book should be reviewed by a computer. Lacking an electronic model, this human computer made random checks with three objectives in mind: typographical errors, errors in data, and errors in the selection of data.

A book of this kind serves a useful purpose only if the information presented is accurate. That a check of about 400 bands uncovered only four typographical errors, all minor, gives the book a very good grade for this test. A failing grade must be given with respect to the test on the accuracy of the data put into the book. I checked 12 compounds (about 90 bands) chosen at random and found errors in the bands reported for four compounds. For example, the book lists two bands (1570 and 1566) for cyclobutene and cites Bellamy as the source. Bellamy actually gives only the 1566 band, and there is only one band in this region of the spectrum. A band at 972 is shown as very strong in a 0.036-mm sample, while the American Petroleum Institute (API) files give a medium to weak band at 972 for a 0.065-mm sample. I found a number of similar errors, but lack of space precludes enumerating them here.

When, as in this book, only a small fraction of the available information can be presented, selection becomes critical. The *Handbook* wastes precious space by giving data from too many compounds of great similarity, for example ten α- or β- *n*- alkylnaphthalenes. On the crucial problem of how to present intensities of the various bands the book fails miserably. More often than not the choice of sample thickness reverses, in terms of very strong, strong, and like designations, the true intensities of the bands. Note, for example, the data for cis-4-octene, with sample thickness in millimeters given in parentheses: 1650 VS (0.239), 1456 S (0.0153), 1381 S (0.064), 1343 VS (0.239). With a logarithmic relation between intensity and thickness, and three different sample sizes, it is exceedingly difficult to reproduce the true state of affairs in a single spectrum from these data. When, as is the case with 7-methylquinoline, no sample thickness is reported the relative intensities become meaningless. The handbook gives three strong bands at 885S, 828S, and 799S, but their true relative intensities are M, VS, and not present, respectively.

Since some 60 percent of the references listed are to the API files or to Bellamy, anyone who has ready access to these sources has little need for this book. I can recommend the book only to those who do not have access to more reliable data, and then only with great reservation.

ELLIOT N. MARVELL
Department of Chemistry,
Oregon State University

Mathematics and Chemistry

Chemical Applications of Group Theory. F. Albert Cotton. Interscience (Wiley), New York, 1963. x + 295 pp. Illus. $12.50.

Chemical Applications of Group Theory is a book from which the average chemist with little flare for mathematics can learn how to apply the results of point-group theory. The author has pared down to a minimum the purely mathematical part of the subject, but at the same time he has provided a large number of examples to illustrate each step. However, in attempting to avoid rigor mortis, he has missed a few points where rigor is required. I do not believe that these are serious, since the examples usually set one straight again. The book is planned for chemists who will not make extensive and sophisticated use of group theory, but who need to be familiar with the notation and simpler results currently used in the chemical literature.

The first section of the book includes a brief chapter on abstract groups, a chapter on molecular symmetry operations, and a detailed chapter on molecular symmetry classification which contains many good examples. The alias and alibi transformations are not explicitly discussed, and usually, but not always, the latter is used. Although only proper and improper rotations are necessary to specify all point-group symmetry operations, the author lists the four conventional types of operation as being fundamental. Representa-