

The new AIP handbook

By Dwight E. Gray

WHAT is a handbook? The word "handbook" seems to have received its start in life as the English form of the German "handbuch", with the adoption not always having received complete approval. In his *English, Past and Present* (1871), Richard Chenevix Trent refers to this handbuch-to-handbook caper and says, "Possessing the word 'manual', we need not have called 'handbook' back from an oblivion of 900 years." James A. H. Murray, in *A New English Dictionary on Historical Principles* (1901), gives the 900 A.D. definition of the Old English "hand-boc" as "a small book or treatise".

By the time of the highly revered second edition of Webster's *International Dictionary*, "handbook" had achieved the status of two basic definitions: 1. A book of reference to be carried in the hand, a manual, a guidebook; 2. A betting book of a bookmaker carried in the hand or on the person to evade laws against bookmaking. (In this context, bookmaking is not to be confused with book manufacturing.)

The treatment of the word in Webster's new third edition demonstrates the realistic acceptance of certain facts of handbook life today. Recognizing that the growth rate of the terminal, prehensile portion of the human arm has fallen far behind that of the size of handbooks, the authors have dropped "in the hand" from both definitions. The first one now reads simply, "A book capable of being conveniently carried as a ready reference." The qualification "conveniently carried" presumably can include transportation by coaster wagon, automobile, bus, plane, train, or ship, as well as by hand. The second definition now includes not only, "A bookmaker's book of bets" but also "A place where bookmaking is carried on." The volume with which this discussion is principally concerned falls into the first of the two basic Webster categories.

The popularity of the handbook as a medium for recording and disseminating knowledge is evidenced by the enormous number and wide variety of publications of this kind. A check of the Library of Congress

card catalog shows no less than 1700 such items under the subject heading of "Handbooks". A hurried, and quite haphazard, thumbing through of these cards shows that among this great library's holdings are handbooks

On or for: Adeline Addicts; Alaska Legislators; Army Wives, Mothers, Daughters, Sisters, Sweethearts, Grandmothers, and All American Women Who Have a Soldier at War;

On or for: Club Women, Conscientious Objectors, Coroners, Cyclonic Storms in the Bay of Bengal;

On or for: New Catholics, New Voters, New Zealand, Newcomers, Nervous People, Narrow-Gauge Railroads;

On or for: Peace, Pakistan, Penmanship, Papua, Perspective, Primates, Patriotic Instruction in Alabama;

On or for: Revivals, Rigid-Frame Analysis, Russian Roots, Rhythm Bands, Roentgen Analyses;

On or for: Louisiana Library Trustees; Life; Leaders of Young Girls; Law for the Use of Connecticut Women; and hundreds of others.

In short, genus Handbook encompasses a multitude of species. When it comes to subjects on which there are handbooks, you name it and someone somewhere almost certainly has compiled one, or will any minute now.

In the mid-1950's the American Institute of Physics became concerned over the lack of any comprehensive handbook in the United States devoted primarily to physics and, in conjunction with the McGraw-Hill Book Company, initiated preparation of such a volume. The first edition, published in 1957, has met with considerable success. Work on a second edition, which got under way a couple of years ago, has been completed and the revised *American Institute of Physics Handbook* has just been published.

the American Institute of Physics Handbook, first published in 1957, has been expanded and brought up to date in a revised second edition. This summary of the main changes to be found in the new edition has been written by Dwight E. Gray of the Office of Scientific Information of the National Science Foundation. Gray has served as the coordinating editor of the Handbook.

As with the first edition, distinguished physicists from the several branches of the field have served as editors of the physics sections; more than half of these were similarly associated with the earlier volume. For the revised edition, the section editors are:

Mechanics—Dr. R. Bruce Lindsay, Dean, Graduate School, Brown University

Acoustics—Dr. Richard K. Cook, Chief, Sound Section, The National Bureau of Standards

Heat—Dr. Mark W. Zemansky, Professor of Physics, The City College of The City University of New York

Electricity and Magnetism—Dr. D. F. Bleil, Associate Director for Research, US Naval Ordnance Laboratory

Optics—Dr. Bruce H. Billings, Vice President, Baird-Atomic, Inc.

Atomic and Molecular Physics—Dr. G. H. Dieke, Chairman, Department of Physics, The Johns Hopkins University

Nuclear Physics—Dr. L. F. Curtiss, Consultant to the Director, The National Bureau of Standards (retired)

Solid-State Physics—Dr. H. P. R. Frederikse, Chief, Solid-State Section, The National Bureau of Standards

Working with these editors have been more than 120 other physicists who contributed various sections and subsections of the contents. It has again been my privilege to serve as coordinating editor of the volume—a euphemistic title for the necessary job of making a spherical nuisance of one's self by unrelentingly nagging everyone involved to get the manuscript in, get the proof out, get the proof corrected and returned, get the printer's inquiries answered, and so forth.

The principal organizational innovation in the second edition is the inclusion of a separate chapter on solid-state physics which contains appropriate material formerly scattered through the other sections, plus a considerable amount of new data. Adding a chapter so named to the conventionally labeled group of mechanics, heat, acoustics, and so forth is, of course, a little

like trying to divide people into women, men, girls, boys, and zither players. (There was, in fact, one suggestion that perhaps the book should contain only three major sections—Solid-State Physics, Liquid-State Physics, and Gaseous-State Physics.) It was decided, however, that the advantages of consolidating solid-state material into one chapter outweighed the disadvantages of a somewhat untidy classification system. To be particularly noted regarding the contents of this chapter are the inclusion of data on tensor properties of crystals of the first, second, third, and fourth rank; energy gaps of organic compounds; diffusion in ionic crystals; ferroelectrics and antiferroelectrics; transition temperatures of several hundred elements, compounds, and alloys; color centers and dislocations; energy-band structure of metals and semiconductors; luminescent and phosphorescent materials; and work functions and secondary emission.

Another new feature of the revised *Handbook* is the inclusion in the "Aids to Computation" chapter of sections called "Analog Computers in Physics Research" and "Digital Computers in Physics Research". These discussions outline the basic principles of the two types of computer and discuss, with examples, some of their applications in research in physics. In the first edition, this initial chapter contained a very limited list of compilations of mathematical tables; the bibliography has now been enlarged to 115 well-annotated references. Associated with it is an alphabetical list of approximately 80 mathematical functions, each keyed to the bibliography entries in which tables of that function can be found.

The seven physics sections that were present in the first edition have been updated and extensively revised; most of them contain kinds of information not presented in the earlier volume. A summary of the more significant changes follows:

Mechanics—Particularly significant is the updating and revision of data on units; on the diffusion, flow, and viscosity of gases; and on the density and compressibility of liquids. Also, the seismological and geodetic material has been substantially revised.

Acoustics—The most recent data on the propagation of sound in solids, liquids, and gases are given, together with pertinent theoretical background. The completely rewritten section on the acoustical properties of liquids is more comprehensive and systematic than was the previous one. Data presented on an improved model atmosphere are based on rocket soundings of the upper atmosphere and on studies of satellite orbits.

Heat—Material not in the first edition includes a collection of thermodynamic formulas, thermodynamic properties of helium and of several gases at very high temperatures, formulas and tables of equilibrium constants of ideal gas reactions, heats of combustion of fuels, and extensive vapor-pressure tables over a wide temperature range. Other features to be noted include low-temperature thermoelectric data; new data on high-

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pressure phase transitions and on temperature variation of the instantaneous coefficient of thermal expansion, along with values of the Grüneisen constant; new values of Debye temperatures and electronic constants; and the latest data on thermal conductivity.

Electricity and Magnetism—Substantial portions of this chapter as it appeared in the first edition have been incorporated into the new Solid-State Physics section of the revision. The revised Electricity and Magnetism chapter includes major expansion of the data on magnetic properties of materials, particularly the diamagnetic and paramagnetic values. The material on the properties of paramagnetic salts, which appeared previously in the Heat chapter, has been expanded and completely rewritten, and is included here.

Optics—Particularly to be noted in this chapter is the inclusion in the revision of new data on the sensitivity, spectral response, and time constants of radiation detectors developed within the past few years. Also worthy of special mention is a subsection on optical masers which includes data only a few weeks old at the time the volume went to press.

Atomic & Molecular Physics—Here, an important addition is that of a subsection on the intensities and strengths of spectral lines. Present use of the orange line of krypton 86 as the international standard of length has been taken into account. Data have been added on the energy levels of rare-earth ions, and the wavelengths of important spectra have been revised, particularly those of iron.

Nuclear Physics—Sections that have been both completely rewritten and considerably expanded include those on the passage of charged particles through matter and on gamma rays. New, in the latter, are numerous curves for mass attenuation and absorption coefficients of photons. Space devoted to listing and describing particle accelerators in the United States and abroad has been more than doubled, as also has the coverage of fission-product chains and yields.

A 1957 *Physics Today* note on the first edition of the *American Institute of Physics Handbook* pointed out that handbooks as a group combine two particularly unfortunate characteristics. The nature of their function makes errors in handbooks more serious than in some other types of publication. At the same time, because handbook content is so largely tabular and composed of relatively unrelated sections, mistakes are less obvious from context, and therefore more easily missed, than in volumes with greater continuity of thought. Again, we shall be grateful if readers will inform us of errors—either of commission or omission. As with the first edition, an errata list, or lists, will be published in *Physics Today*. Communications should be addressed to the American Institute of Physics, 335 East 45th St., New York 17, N.Y., attention Dwight E. Gray, Coordinating Editor, *AIP Handbook*.