in a proposed experiment and permits changes before the experimenter becomes irrevocably committed. The design of experiments is a subject in itself and the authors announce their intention of making it the subject matter of a second volume.

The second and third chapters of this first volume go into considerable detail about basic statistical concepts such as distributions, averages, and measures of dispersion. This calls for considerable patience to reach (in the appendix to Chapter 4) a worked-out example of the conventional t-test for the comparison of the averages obtained by two different processes. The next chapter on the analysis of variance outlines its application to fairly complex experiments including methods for missing values. The remaining chapters take up the fitting of straight and curvilinear lines, the interpretation of data obtained by counting, sampling, and the use of control charts. The beginner will be glad to have the glossary of statistical terms and symbols, and the more useful statistical tables.

The authors of this book are not professional statisticians. They have included a good deal more than might be expected in an introductory work. This may discourage some readers. On the other hand the book has something of the handbook about it. Chemists will profit by placing this book on their reference shelves.

W. J. Youden

**ORGANIC CHEMISTRY**


It is a pleasure to welcome this new English edition of Karrer's classical work. Although the number of pages in this edition is only sixteen greater than in the preceding edition, some new sections have been added, and revisions have been made in a number of chapters. "For example, sections on the following subjects have now been included: polysiloxanes and other organic silicon compounds, diacyl peroxides and peracids, streptomycin, organic compounds containing isotopic carbon and nitrogen, etc. The following parts have undergone substantial alteration or change: the chapters on elementary microanalysis, mineral oil products, organic lithium compounds, oestrogenic substances (doisynolic acid, synthesis of oestrone), vitamins (pteroylglutamic acid, vitamin A), the coloring matter of blood and related compounds, alkaloids (retroeneic alkaloids, solanine-solanidine, N-methylmorphinan synthesis, etc.), and cyclooctatetraene."

There are occasional typographical errors, but these are not serious. The binding is good, and the book should stand up well under the appreciable use it will get as a text and reference work.

Henry Gilman

**THE CHEMISTRY AND METALLURGY OF MISCELLANEOUS MATERIALS**


If one were concerned with the problem of producing one of the less familiar elements, say hafnium, in the metallic state, he would have to select the compound to be reduced and the reducing agent; to decide whether to use a crucible or not, and if one is to be used, to select a suitably refractory one; to determine what atmosphere to use; and then finally, to determine the temperature and pressure for the most favorable rate of reaction. This book supplies the kind of thermodynamic data needed for planning such preparations. While the editor reports in his Preface that "the final list of papers includes surveys on the thermodynamic properties of the elements and several classes of their compounds, surveys on the crystal chemistry of many materials, papers on geochemistry and on the chemistry and metallurgy of beryllium and of the rare earth elements and other topics," it appears that the greatest contribution is that outlined above. The subjects of the papers add further evidence on this point:

"Investigation in the liquid-solid equilibrium of the two-component systems composed of the bromides and iodides of strontium and barium."

"Temperature-composition diagrams of metal-metal halide systems."

"The thermodynamics and physical properties of the elements."

"Thermodynamic and physical properties of nitrates, carboxylates, sulfides, silicides and phosphides."

"Thermodynamic properties of common gases."

"Thermodynamic properties of the halides."

"The fusion and vaporization data of the halides."

"The thermodynamic properties of molybdenum and tungsten halides and the use of these metals as refractories."

"The heats of formation of CuS, CuS₂, and CoS₂ at 25°C."

"The heat of reaction of the cerous-cesic couple in 0.5 mol perchloric acid at 25°C."

Most of the papers were written by wartime workers of the Department of Chemistry of the University of California, and were first issued as Metallurgical Laboratory Reports from the Manhattan Project at the University of Chicago. References to the original reports are given in each instance. The data are thoroughly supported by citations of original work, and where data have had to be estimated the basis of the estimate is supplied. Moreover, in the appendices to Paper 6, the methods of calculating heats of formation from lattice energies and heats of solution and the methods of calculating equilibrium constants for high-temperature reactions from low-temperature data are illustrated fully. In Paper 7, the various types of vaporization processes that are likely to occur at high temperatures, that must be taken into account in making predictions based on thermodynamic calculations, are given with particular reference to halogenides. These discussions alone make this collection of papers worthy of a place on the laboratory shelf.

Except in the Manhattan Project Reports, upon which this volume is based, there is no really accessible compilation of such thermodynamic data covering all of the 92 then known elements. In addition, there are collected other pertinent properties such as melting points, boiling points, vapor pressures, and reactions with water, and with acidic and alkaline solutions, for many classes of compounds. Nitrogen compounds, for example, are discussed in general chemistry courses, but very rarely are nitrates mentioned. Students remain unaware of such remarkable compounds as Ti₃N, ZrN, HFN, all of which melt at around 3000°C, are metallic in appearance, and are good conductors of electricity. The sulfides, Th₃S, Ce₃S₄, which have similar properties, were not even known to exist prior to the work reported in this book. Publication of this collection of papers will be of great interest, thus, to inorganic chemists and to process metallurgists who will find it invaluable.

The publishers should be commended for making a book of this quality available for such a low price. The lithographed book is very satisfactory and in the future is bound to give the type-set edition of scientific works serious competition, as the latter certainly are not now available for the approximate price of a cent a page. Since technical books can be expected to have only a short life span, it is a boon to the scientific worker to be able to obtain them for this remarkably low price. It is a pleasure to be able to recommend this book to the readers of This Journal.

Laurence S. Foster

Belmont, Massachusetts