will be grateful to the authors for the great pains they have taken in detailing all the steps that must be taken in accumulating accurate powder data and in extracting the most useful information from that data. No step in the procedure is so simple that they leave it out and none is so complex but that they attempt a clear and lucid explanation of it. Nothing is as good as an experienced instructor, but this book is certainly the next best thing, and the experienced instructors themselves will make much use of it.

The last four chapters cover, in the same admirable style, some of the more specialized techniques such as particle size from line-broadening, stress measurement, preferred orientation, radial distributions, and finally small angle scattering. Appendices cover the equipment of a laboratory and its processing rooms.

Not the least valuable are the vivid illustrations. Some are photographs, many are excellent sketches which illustrate intricate points of technique. There are countless practical examples and useful tables in the appendices and in the text.

This book is a must for every laboratory working in this field. It will probably not be read through by many, but each group will blacken its own particular set of pages with the thumb marks of constant reference.

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Molecular Theory of Gases and Liquids. By JOSEPH O. HIRSCHFELDER, Department of Chemistry and Naval Research Laboratory, University of Wisconsin, CHARLES F. CURTISS, Department of Chemistry, and Naval Research Laboratory, University of Wisconsin, and R. BYRON BIRD, Department of Chemical Engineering, University of Wisconsin. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1954. xxvi + 1219 pp. 16 × 23.5 cm. $20.00.

This book is one of encyclopaedic dimensions; yet, on reading it, one gains the impression that it is compressed. Even for a book of 1200 pages it contains a great amount and a great variety of material. It is divided into three parts—one on the equilibrium properties of gases and liquids, one on the transport properties, and one on intermolecular forces—any one of which could comprise a volume in itself.

The first chapter of the book is an introduction to the three parts mentioned above. It contains a very elementary account of the equation of state and of the kinetic theory of gases, the latter based upon a model which does not consider the distribution of velocities, a brief discussion of the methods used in the more rigorous theory, an outline treatment of intermolecular forces, a discussion of classical mechanics with particular attention to molecular collisions, and an introduction to quantum mechanics.

Part I starts with a chapter on statistical mechanics. The next chapter is a discussion of the equation of state of dilute gases, with particular emphasis on the calculation of second and third virial coefficients for a considerable variety of intermolecular potentials, using the cluster integral methods. This is followed by a treatment of dense gases and liquids, starting with various empirical equations and a discussion of the principle of corresponding states, and including discussions of cell theories, hole theories and the radial distribution function. There is then a chapter on the equilibrium between liquid and vapor, including a discussion of surface tension. Quantum theory and quantum effects at low temperatures are considered in a special chapter by J. de Boer and R. B. Bird.

Part II deals with the transport properties of gases, a large portion of it being devoted to what is generally called the kinetic theory of gases. It is based for the most part on the Maxwell–Boltzmann equation and the various equations of change and of continuity, essentially no use being made of the mean free path. Frequent reference is made to Chapman and Cowling's "Mathematical Theory of Non-Uniform Gases," which gives a more detailed account of many of the topics treated, but which is, of course, not as up-to-date as the book under review. The latter, for example, makes some reference to the statistical mechanical theory of non-equilibrium processes which is being developed by Kirkwood and his collaborators. A vector and tensor notation is used in this part of the book, this notation being explained, somewhat inadequately in my opinion, in a section at the beginning of the book. A reader who is unfamiliar with, or rusty on, this notation will do well to first read Chapter 1 of Chapman and Cowling, noting some slight differences. In the chapter on dense gases and liquids the more sophisticated treatment is supplemented by a discussion of Eyring's theory of viscosity and other transport phenomena and an Appendix gives a brief account of the activated-complex theory of reaction rates, upon which this theory of viscosity is based. Incidentally (though not too important for the purposes of the book as a whole), this Appendix quotes approvingly Gershinowitz and Eyring's incorrect interpretation of the negative temperature coefficient of the oxidation of nitric oxide. After a discussion of quantum effects, again by J. de Boer and R. B. Bird, Part II ends with a chapter which is unusual in a treatment of the kinetic theory of gases; it includes, among other topics, thermodynamics of irreversible processes, sound propagation, flame propagation, and theory of detonations.

Part III is a discussion of intermolecular forces, from the theoretical point of view, though with numerous applications to experimental data. It includes a discussion of electromagnetic phenomena, propagation of light in material media, etc. Not only are the various types and causes of ordinary intermolecular forces considered, but also the forces involved in chemical reactions, though no detailed discussion of chemical binding is given. Intermolecular forces are, of course, involved in Parts I and II, and Part III was designed to give an understanding of them. While we do have a general understanding of intermolecular forces, the calculation of them is generally too involved to be carried out in detail. At the same time, the virial coefficients and transport properties are insensitive to the exact form of the intermolecular potential-energy curve. Some figures are given in the book under review, in which curves for the rare gases, as obtained from various equations, with parameters adjusted to best fit the experimental data, are compared with each other and with theoretical curves. General satisfaction is expressed with the agreement between the various curves, but it may be a matter of opinion as to just how good this agreement should be said to be, and there is no indication as to how great a range of curves might still fit the viscosity data and the virial coefficients.

The book has a number of problems at the end of the chapters, which the authors hoped would be of assistance to students desirous of learning the subject. It is my opinion, however, that the book itself will not be very helpful to such students, since there is a preference almost throughout for formal mathematical procedures rather than the intuitive approach. This is illustrated for example, by the almost complete lack of discussion of the mean free path in the kinetic theory of gases. It is shown also in the discussion of the virial coefficients, where the most general form of cluster integral development is given, and no mention is made of the interpretation of gas imperfections in terms of actual molecular association. To go from one equation to another in the various developments is often a minor research problem. Thus the book will appeal most to people who are actually working on the subjects covered. For such persons it has some very valuable features. It brings together a great diversity of more or less related topics, and summarizes recent researches in these fields. Hirschfelder and his coworkers at the University of Wisconsin have made valuable contributions to many of the subjects treated, and their researches and related researches are discussed, complete with extensive tables of quantities which occur in the calculations. These tabulations should prove very valuable to anyone working along these lines.

In reviewing such a large book it is difficult to make detailed comments. I will confine myself to a few critical remarks on subjects touching on my own researches. In the first place I may say that I do not consider the treatment of critical phenomena to cover properly present day knowledge of the subject. Again, the treatment of communal entropy appears to me to be inadequate and misleading. The communal entropy of a solid cannot be properly understood from a cell theory which arbitrarily excludes it. Finally, if a somewhat personal note may be injected, I may say that I was somewhat surprised to find that my earlier work on intermolecular forces in solid argon was quoted in some detail without adequate discussion of the difficulties involved.

whereas my later work, in which I modified my conclusions was ignored without explanation.

In as large a book as this, however, individual critics, especially familiar with the topics treated in particular portions of the text, could no doubt find many points of disagreement and dissatisfaction, while agreeing that on the whole it will be an essential tool for all specialists in the field. It certainly should be acquired by libraries of chemistry and physics, and research workers in the particular branches covered.

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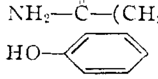
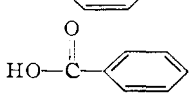
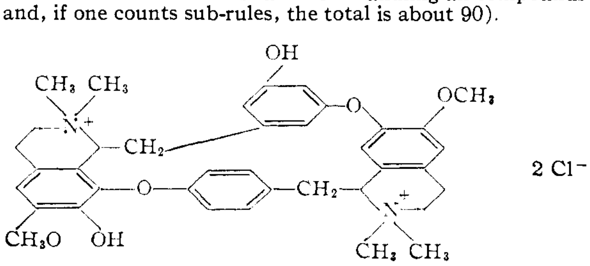
A Line-Formula Chemical Notation. By WILLIAM J. WISWESSER, Head of Industrial Hygiene and Chemical Research, Willson Products, Inc., Reading, Pennsylvania. Crowell Company, 432 Fourth Avenue, New York 16, N. Y. 1954. x + 149 pp. 15 × 22 cm. Price, $2.00.

It is becoming more and more apparent that the skill and industry of chemists in preparing new compounds is outstripping the ability of our nomenclature experts to assign good chemical names and to complete satisfactory indexes by conventional methods in a reasonable length of time. To remedy this weakness, several authors have in recent years invented linear notations for describing compounds in terms of symbols with conventional, evident, or easily remembered meanings. Wiswesser's notation is described in the manual under review.

The nature of the new notation is illustrated by the following examples for (simple) compounds:

Structural formula	*Notation*
NH_2—NH_2	ZZ
NH_2—$(CH_2)_4$—OH	Z4Q
NH_2—C(=O)—$(CH_2)_5$—CHO	ZV6:0
	QR
	QVR

Naphthalene is designated as (66), decalin as (6/6/), quinoline as (66.bN). The notation yields one and only one correct line-formula for each compound; accordingly, in principle the notation can be used for purposes of indexing. The symbols are limited to those commonly found on a standard typewriter keyboard. Complex compounds require rather involved rules, and yield exceedingly complex ciphers (*e.g.*, tubocurarine, shown below), but it is gratifying to note that 36 main rules suffice for handling all compounds (and, if one counts sub-rules, the total is about 90).



Tubocurarine, (-j(6/6.cK)h01iQb1RdQc0-i(6/6.cK)h01b1-Rd0-),.G_2

The presentation of the system is made in a logical and straightforward manner, with numerous examples, and with headings in bold-face type. There are excellent review exercises, with correct answers, at the end of each chapter, and the manual is well indexed (a very important point in a coding manual).

In the opinion of the reviewer, an hour's skimming of the manual enables one to catch sufficient key ideas to encode and decode simple examples, and several hours suffice for handling most of the frequently occurring compounds with a fair degree of confidence. However, many hours of practice and study would be required for one to become letter perfect in the use of the notation, and a small fraction of compounds would probably always give trouble.

It is a revelation to most of us that one man could work out a comprehensive system for representing all chemical compounds by a linear notation. No conventional nomenclature has yet been able to achieve this goal. Furthermore our interest is increased when we learn that the author has given strict preference to "those familiar methods that require the least writing, the least new learning, and the least memorizing." Like Sir Isaac Pitman's shorthand, Wiswesser's notation is a masterpiece to be admired for its ingenuity, but like shorthand its real value will depend on its acceptance and use by others.

FELLOWSHIP IN MEDICINAL CHEMISTRY
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Basic Mechanisms in Radiobiology. II. Physical and Chemical Aspects. By JOHN L. MAGEE, Notre Dame University, Notre Dame, Indiana; MARTIN D. KAMEN, Washington University, St. Louis, Missouri, and ROBERT L. PLATZMAN, Purdue University, Lafayette, Indiana (Editors). National Academy of Sciences–National Research Council, Washington 25, D. C. 1953. viii + 145 pp. 17.5 × 24.5 cm. Price, $1.00.

This volume is an abridged verbatim transcript of the proceedings of an informal conference of twenty-three physicists, chemists and biologists brought together to discuss the interaction of radiation and biological systems in its basic physical and chemical aspects. The subject is reported under five general headings. I. Initial Energy Transfer from Incident Radiation to Matter. II. Energy Transfer from Secondary Electrons to Matter. III. Mechanisms of Energy Degradation and Chemical Change: Effects of Secondary Electrons. IV. Mechanisms of Energy Degradation and Chemical Change: Effects of Electronic Excitation. V. Summary: Importance of Radiation Chemical Effects in Radiobiology.

The presentation of the discussions in verbatim form preserves an atmosphere of informality and gives the reader a sense of vicarious participation in the conference. From time to time interesting glimpses are given of research now in progress or being contemplated. Despite an occasional discontinuity or *non-sequitur* in the report, it is evident that the conference admirably explored the frontiers of this complex and increasingly important area of radiobiology.

The work should prove to be of substantial value to those engaged in teaching and research in radiation biology, and of interest to chemists and physicists studying reaction mechanisms and kinetics.

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BOOKS RECEIVED

February 10, 1955—March 10, 1955

RICHARD J. BLOCK, EMMETT L. DURRUM AND GUNTER ZWEIG. "A Manual of Paper Chromatography and Paper Electrophoresis." Academic Press Inc., Publishers, 125 East 23rd Street, New York 10, N. Y. 1955. 484 pp. $8.00.

ERWIN CHARGAFF AND J. N. DAVIDSON (edited by). "The Nucleic Acids," Chemistry and Biology. Volume I. Academic Press, Inc., Publishers, 125 East 23rd Street, New York 10, N. Y. 1955. 626 pp. $16.80.

E. C. HORNING, Editor-in-Chief. "Organic Syntheses." Collective Volume 3. A Revised Edition of Annual Volumes 20–29. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1955. 890 pp. $15.00.