finally assignment sheets of problems without answers are included. Sufficient problems are listed so that each teacher can select or reject as will.

Methods used to illustrate the solution of problems are based on an understanding of principles rather than on memorization of formulas. Careful analysis of the problem before undertaking its solution is emphasized. Teachers favoring this approach should find this book very useful.

- A LABORATORY MANUAL OF GENERAL CHEMISTRY


In this manual there are 46 experiments. The emphasis is more on fundamental principles and quantitative relationships than is usual in most first-year courses. Another departure from the average course is the authors' use of the laboratory quiz to supplement the usual laboratory notes or answers to questions. In this manual the only papers to be handed in are the data sheets, which, in most cases, contain only the quantitative data and calculations. A list of study questions is given at the end of each experiment and a quiz on some of these questions is to be given at the end of each day's work.

Lists of reagents required for the experiments are appended.

- GENERAL CHEMISTRY FOR LABORATORIES


There are 87 experiments in this manual varying in length from a single operation to those requiring several hours. Previous knowledge of chemistry is not required but the successful completion of the exercises requires the student to carefully observe and interpret results. Directions are brief and explanations are kept to a minimum. Questions are thought provoking.

The manual is essentially inorganic, the only organic experiments included being those referring to hydrocarbons and fuels. Many tests for metallic and nonmetallic ions are given but no systematic scheme of qualitative analysis is included.

Space is allowed for answers to questions but no provision is made for removing pages to hand in experiments.

- CHEMISTRY FOR THE LABORATORY


This manual contains 78 experiments written for beginning students of average ability. Many experiments, especially in the first half of the book, are quantitative. Throughout the emphasis is on the needs of students in engineering and other non-chemical fields. Directions, explanations, and questions are complete and usually simple and easily understandable. Many of the individual tests and general principles of qualitative analysis are used, but no systematic scheme of analysis is included.

There are 12 experiments on organic materials. Experiments vary considerably in length.

Pages are perforated to hand in and punched to fit a standard notebook. Spaces are allowed for writing in answers to questions. Complete lists of apparatus and quantities of reagents needed for ten students are included in the appendix.

- MANIPULATIONS DE CHIMIE


This collection of more than 700 procedures for preparing inorganic and organic substances is intended to teach the various types of manipulations. The starting materials are inexpensive; the time for any one preparation is not more than a week; the apparatus can be readily assembled or constructed from standard parts.

The operations are planned to illustrate general laws and rules, hence the exercises reinforce what has been stated in the lectures. Physical constants are given to enable the student to identify his product or to check its purity. Analytical operations have been omitted except with respect to the preparation of derivatives characterizing organic functional groups. Although most of the important types of reactions have been included, certain ones have been passed over because they involve no new and significant technique or because they are not suited to large classes.

For the most part the procedures are taken directly from the literature (the literature references are given) though frequently the directions are modified because the author has found that the yields can be improved by changes or by paying particular care to certain details. The preparations are grouped by methods rather than by chemical relationships, since two materials of the same kind sometimes require very distinct types of preparational procedures; e. g., selenium oxide (solid) and sulfuric oxide (gaseous).

The inorganic portion covers 138 pages, the organic part, 187. The indexes are unusually complete. The placing of the necessary tables in the beginning of the text comes as a surprise to the American reader.

The book has certain defects, though these are not too serious if it is remembered that this is a teaching tool and not a reference volume. Most of the procedures are rather old and better methods are now available. The directions are none too full in certain cases and the literature will have to be consulted by the independent worker, an obvious drawback in some localities. Hazards are not stressed, such as danger of fires or explosions, toxicity of products, etc. A few mistakes in formulas were noted; morpholine (page 305); diazomethane (page 306) for instance. The introductory remarks (Generalities) of the various divisions are rather sketchy and of small actual value.

The book is well printed; the figures are clear and well drawn. The text has obviously found favor in French schools but its place in the usual American curriculum is problematical. Nevertheless, it would be a good addition to the departmental library, where it could be used as a source of possible procedures and especially as a fine collection of exercises for those wishing to gain facility in reading chemical French.

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- VINYL AND RELATED PLASTICS


Schildknecht is such a wealth of information presented in such readable style as is achieved in this book.

The subject has become one of foremost industrial importance in the last fifteen years, and the author has given major emphasis to its practical aspects. However it is difficult to get access to information that is regarded as the competitive stock-in-trade of industrial concerns. In many cases, however, the patent literature has been supplemented with descriptions of related products and processes which were developed in Germany and
described since the war in detailed reports by technical teams. With his own experience in evaluating the commercial practicability of published examples and claims, the author has presented a survey that is comprehensive indeed. The literature appears to have been covered with painstaking care and judicious appraisal. The book contains over 4000 references dating from 1832 to the second half of 1951.

Topics covered are: styrene polymerization (written as an introduction to polymer science); styrene copolymerization; styrene derivative and related polymers; metacrylic and acryl ester polymers; acrylonitrile, acrylic acid, and related polymers; polymers from vinyl acetate and related monomers; vinyl chloride polymers; vinylidene chloride and fluorovinyl polymers; ethylene high polymers and copolymers; high polymers and co-polymers of isobutylene; vinyl ether polymers; sulfur-vinyl compounds; nitrogen-vinyl polymers; vinyl ketone and miscellaneous polymers.

The book is stoutly bound, printed on paper of good quality, and contains remarkably few typographical errors for a first edition. Its price notwithstanding, this book should appeal to nearly every chemist, whether its value be directly related to his own activities in the polymer field or a matter of his being informed on a timely and important subject. It will certainly be recommended by the industrial research staff to the recent graduate who is starting a career concerned with vinyl polymers. There is every reason to hope and expect that this book will find its way into the classroom.

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THE SURFACE CHEMISTRY OF SOLIDS

This little book is a survey of a widely dispersed field of investigation—the phenomena which occur at the surface of a solid. The author's attempt has been to systematize the information, both empirical and theoretical, in terms of principles and thus to indicate the present status of knowledge of the subject. The result is that he has produced a valuable book which occupies a position in the scientific literature midway between an exhaustive treatise, useful as a reference work, and an uncritical, qualitative presentation suitable only as an introduction to the subject. The topics treated range from the contrasting theories of multilayer physical adsorption of gases on solids to the soldering of metals; from catalysis and chemisorption to the water repellance of ducks' feathers.

A unique feature of this book is the author's apparent reluctance to be drawn into discussions of those surface phenomena which are traditionally classified as "colloid" chemistry. He defends the arbitrariness of this by suggesting that these are "such important subjects in their own right that it would be somewhat forced to regard them as subdivisions of surface chemistry." This point of view results in the complete omission of all mention of the manifold effects of the adsorption of ions by colloidally dispersed solids, etc. The choice of subject matter emphasizes, rather, the significance of surface effects (particularly adsorption) in the ordinary chemical and physical interactions of matter. For example, there are chapters devoted to Adhesion and the Effect of Adsorption on It, The Spreading of a Liquid over a Solid, and The Part Played by Surface in Chemical Reactions. Experimental techniques pertinent to the problems of surface chemistry are described. These ranges from the accurate determination of densities in various liquids to the electron microscopy of surfaces. A great variety of applications to the practical problems of industry (such as friction and lubrication) are indicated.

The phenomena associated with the adsorption of gases by solids receive considerable detailed review. These discussions, rather unfortunately are broken into isolated portions by the chapter arrangements. Clear-cut distinction between physical adsorption and chemisorption is not immediately apparent. Incorrect impressions might result from casual inspection or piecemeal reading of these sections.

Students in introductory physical chemistry courses will find this book interesting and valuable as supplementary reading. It certainly belongs on encyclopedic library shelves. It is very readable and amply illustrated. The photographs and electron micrographs are well chosen and clearly reproduced. The author provides each chapter with a concise summary, a list of references and a short bibliography.

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THE NATURE OF SOME OF OUR PHYSICAL CONCEPTS
P. W. Bridgman, Professor of Physics, Harvard. Philosophical Library, New York, 1952. 64 pp. 4 figs. 15.5 X 23.5 cm. $2.75.

This book presents three lectures which were given in 1950 under the auspices of the Department of the History and Philosophy of Science at City College, University of London. They were published in the January, April, and August, 1951, numbers of the British Journal for the Philosophy of Science. In subject matter, they represent an even more penetrating analysis of certain physical concepts than the author has given in his books, "The Logic of Modern Physics," "The Nature of Thermodynamics," and "The Thermodynamics of Electrical Phenomena in Metals."

The first lecture takes up the general operational approach, and shows how in our concepts we jump back and forth between instrumental operations and mental operations. The mathematician may say, "We will now perform the operation of differentiating this equation," but his "operation" does not mean the same as that of the physicist who says, "I will now take my ruler and measure this object."

The second lecture is concerned with thermodynamics. Operational definitions necessarily refer to those concepts that are not correlated upon any preconceived structural theory of matter. Thus they can be applied to thermodynamics, because if (imagining the impossible) the atomic theory were disproved tomorrow thermodynamics would remain. By the operational definition of entropy we can only speak of the entropy of a body if there exists some reversible way of reaching its state. "But many of the bodies of experience are in such a state that every change to which the body is subjected contains some component of irreversibility. An example is any piece of metal which has been heavily strained plastically.... Incidentally, the whole living world of biology is thus isolated.... For if the entropy concept were applicable, it would involve some reversible method of getting from the nonliving to the living, and this involves at the least the artificial creation of life, an operation which we cannot at present perform." Underlined by this difficulty, Professor Bridgman suggests the lines of a possible extension of the concept of entropy whereby "we may attack the problem by methods in the spirit, if not the letter, of classical thermodynamics."

Classical physics makes frequent use of "mental experiments." A unit charge is introduced into a "field," and the force of it is measured; a smaller charge is then introduced, and then successively smaller ones, and the limit of force per unit charge is taken. Another example is the familiar "Carnot's engine" with its highly unreal system of perfect conductors and perfect insulators, which can be approached by a theoretical infinitely slow operation taking infinite time. By such devices "usually it is possible to give the system such dimensions or otherwise modify it so that the irreversible aspects may be made vanishingly small in comparison with the reversible ones."

But in a thermo-