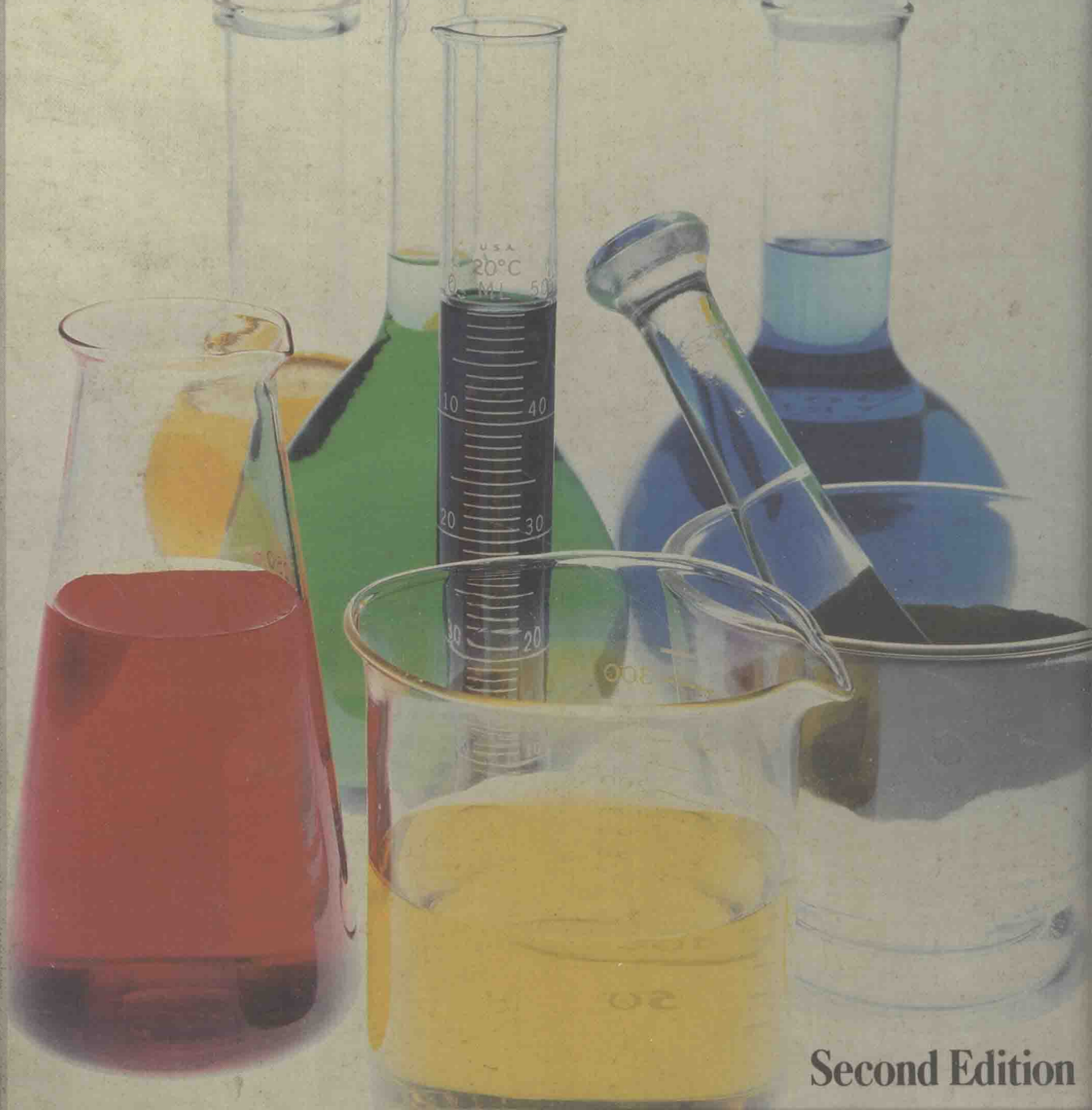


CHEMICAL TECHNICIANS' READY REFERENCE HANDBOOK

Shugar/Shugar
Bauman/Bauman



Second Edition

CHEMICAL TECHNICIANS' READY REFERENCE HANDBOOK

Second Edition

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**CHEMICAL
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THIS BOOK IS REDEDICATED WITH ALL OF OUR LOVE
TO HELEN BRAUER SHUGAR, BY HER FAMILY, THE
AUTHORS: HUSBAND, SON, SON-IN-LAW, DAUGHTER

*Gershon J. Shugar Ronald A. Shugar
Lawrence Bauman Rose Shugar Bauman*

PREFACE

The first edition of the *Chemical Technicians' Ready Reference Handbook* elicited a flood of constructive advice and comments from the scientific community. Many of these letters suggested that we include other, new, and more sophisticated laboratory procedures in the second edition. Others requested that we incorporate a wide range of new sections and topics. To all who took the time and trouble to communicate with us and give us their input we are very grateful. We do appreciate their recommendations and ideas on the scope and depth of our second edition. We hope that this practice will continue so that we may continue to produce the most comprehensive, useful, and readily available handbook for the professional.

The premise of the preface of our first edition is made more valid with this second edition. The authors, within practical constraints, have attempted to include as much material as possible to truly meet the needs of the industry for a ready reference handbook.

This Handbook is designed to be an “omnibook” for the chemical technician, for the high school student, for the college student who is taking laboratory courses, for the graduate student who needs a ready source of information which meaningfully relates to actual laboratory practice, and for the trained chemist. In fact, this Handbook is designed to provide anyone with *every single step* to be followed when performing normal laboratory procedures.

It provides refresher guide steps to the professionally trained chemist, chemical engineer, chemical assistant, or chemical technician who, because of nonactivity in the laboratory, has forgotten the exact procedures required to do a particular job.

The Handbook provides anyone, at any level of training, with instructions, written in simple statements, on all commonly used laboratory procedures. The book details what equipment is needed, what each piece of equipment looks like (with photographs or drawings), how the pieces are used in a procedure, the sequential steps to be taken in performing the determinations or acquiring the experimental data, the cautions which must be observed, and finally the raw data, observations, and calculations which may be needed to utilize the experimental data.

With the Handbook, technicians have at their fingertips all the information, procedures, techniques, and methods that they need. They can determine immediately whether they have the component parts and apparatus required for a specific purpose, thus saving valuable time. The numerous illustrations of the pieces of equipment, glassware, and

apparatus assist technicians in ordering any necessary items from a laboratory supply house. Furthermore, technicians have the complete and simplified step-by-step instructions for procedures and methods involving electrical equipment, assemblies, troubleshooting, and safety. Special sections include basic first aid, refresher mathematical procedures, the use of the hand-held calculator, useful reference and conversion tables, symbols and abbreviations commonly encountered by the professional, and a comprehensive manual of glassblowing. This Handbook provides anyone who wishes to perform a laboratory procedure with the WHO, WHAT, WHEN, WHERE, and HOW of doing it.

Gershon J. Shugar
Ronald A. Shugar
Lawrence Bauman
Rose S. Bauman

PERSONAL ACKNOWLEDGMENTS

The authors wish to congratulate and compliment the following people for their substantial assistance in the development and completion of this Handbook. We do believe that their help, guidance, and advice have been of inestimable value, enabling us to produce this comprehensive and valuable working tool for chemical professionals most effectively and efficiently.

Harold Crawford, Editor in Chief, Handbooks and Technical Books, in the Professional and Reference Division of the McGraw-Hill Book Company, effectively marshaled and coordinated every needed facility from the vast resources of McGraw-Hill to help us in every way possible. We appreciate his special help. And we wish to thank him for seeing the need for a greatly expanded second edition, comprehensive in scope, with the depth requisite to meet the need of chemical technology today.

Ruth L. Weine, Senior Editing Supervisor, McGraw-Hill Book Co., review-edited the manuscript with a dedication far and above the call of duty. With her extensive training, background, and experience in the chemical laboratory and as a science and project editor for highly technical books, she was able to provide the authors with invaluable guidance and assistance. We acknowledge with gratitude everything that she did to make this Handbook a work of which we can all be proud.

Rudolph B. Jones, Assistant Professor, Essex County College, Newark, N.J., gave the authors invaluable help based upon his far-ranging experiences as a bench chemist and as an instructor of chemical technicians. He has actively trained many hundreds of young people who had no prior technical background to become chemical technicians both at the College and at career trade schools. His background encompasses the entire area of practical chemical technology.

Mr. Robert Hofstader of the EXXON Research Center, Linden, N.J., is one of the chemical industry's participants in the creation and structuring of teaching materials for chemical technicians. His core material was a guiding light for the authors in producing the first edition of the Handbook. Much of what he supplied us is incorporated in this second edition. We are grateful for that help.

LABORATORY EQUIPMENT AND SUPPLY COMPANY ACKNOWLEDGMENTS

Through this second edition you will find many photographs and cuts of laboratory equipment and glassware, in addition to numerous line drawings drafted specially for this book under the supervision of George Oechsner. Those photographs and cuts were supplied by a number of chemical laboratory equipment and supply companies at the request of the authors. You will note that their company logo may be seen on many of them.

These companies will send, on request, a complete catalog of what they manufacture, sell, and service. The pictures are *representative* of the items that you will use. You, of course, may require special ones, depending upon your needs. The illustrations are provided to give you an idea of what the item looks like, what it is used for, and the scope and capacities of available items.

The laboratory-supply companies listed are distributors of nationally made products, and each company may manufacture its own line of products. You should choose the item which best serves your needs. Many times, other equipment will serve your purpose, provided it is used properly.

The catalogs issued by laboratory-supply companies accurately describe the items and give the specifications, capacities, and range of the items, and the approximate prices. Upon request, these companies will give you their terms and delivery schedules, and the warranties on the items.

Should you desire, these companies will, upon request, provide you with representatives to assist you in selecting the apparatus best suited to your technical and budget requirements. After you have purchased the specialized, higher-priced instruments, their representatives will instruct, assist, and train you in the use of their apparatus.

The catalogs available from these companies contain up to 1,500 pages and include as many as 50,000 items. The illustrations in this book are representative.

Laboratory-supply companies also supply chemicals, equipment-repair services, and laboratory furniture; their offices are interconnected to their branches to give you fast delivery.

These companies spent their money and the time of their busy employees to provide us with the materials that we requested. The authors wish to

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