

## BOOK REVIEWS

### Fehler bei chemischen Analysen

Karel Eckschlager, Prague, Czechoslovakia. Translated from the revised (1863) Czechisch edition by Oswald Gürtler, Leipzig, East Germany. Akademische Verlagsgesellschaft Geest & Portig K.-G., 701 Leipzig, Sternwartenstrasse 8, East Germany, 1965. 164 pp. 16 Figs. and 30 tables. 16 × 23 cm. MDN 24.50 (= approx. \$6.25).

This book deals with a matter of prime importance to those seriously concerned with quantitative analysis, namely the inevitable occurrence of errors. The degree of precision in the obtained results is obviously of fundamental significance. Also of special importance is a knowledge of the possible sources of error in the actual procedures and the propagation of errors in the calculations. Only with such knowledge is it possible to discover ways to increase the accuracy of the work.

The book is aimed especially at students, teachers, and practicing chemists. The language is straightforward; even the German text is not difficult for those whose knowledge of that language is what can be assumed in the majority of those reading the book, i.e., of those really interested in their field of work. Many of the references are to articles that have appeared in German, others were published in English. A few references are to the Russian literature. Though there is constant use of mathematics, the latter is not beyond simple algebra. The figures are clear and are well explained. The book should be read in small segments that can then be thoroughly digested. A knowledge of the pertinent laws, theories, etc. is taken for granted. The examples are drawn from actual cases and cover a wide range of types of analysis. In short, this book covers the subject well and fits the needs of those in the medium as well as the advanced stages.

After a general discussion of errors that may be encountered in chemical analyses, there follows a competent treatment of the errors introduced by imperfections in the apparatus, standard solutions, etc. Errors arising in weighings, titrations, colorimetric and other instrumental procedures are taken up in adequate detail. The required methods of mathematical statistics are presented and the final chapter is given over to the graphic and numerical methods for evaluating the analytical results. The five chapters are divided into divisions (65 in all) and this makes for flexibility. The author knows his subject thoroughly and, what is of equal or greater importance, knows how to transmit this knowledge to the reader. In other words, here is a first class treatment of the subject. The first printing of the German translation was sold out quickly. The publisher has done his part well. The book is clearly printed on good paper and the binding is durable. This book deserves a wide distribution

among the analytical fraternity. The price is very moderate.

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### Organic Chemistry: A Brief Course

Walter W. Linstromberg, University of Omaha. D. C. Heath and Company, Boston, 1966. xiv + 432 pp. Figs. and table. 16 × 23 cm. \$7.95.

### Organic Experiments For A Brief Course

Walter W. Linstromberg, University of Omaha, and Henry E. Baumgarten, University of Nebraska. D. C. Heath and Company, Boston, 1966. v + 183 pp. Figs. and tables. 16 × 23 cm. \$3.80.

This text attempts to present the essentials of elementary organic chemistry for a one semester course with an introduction to molecular orbitals and chemical bonding as well as reaction mechanisms and theoretical principles. It retains the traditional subject matter organization by homologous series for alkanes, alkenes, and alkynes and thereafter considers together aliphatic and aromatic compounds with the same functional group. The chapters on fats, carbohydrates, and proteins include sections on metabolism and that on heterocycles contains a descriptive section on natural products. There is a chapter on photochemistry that treats dyes and spectroscopy.

The problem of presenting a modern organic chemistry course that includes structure theory, important reactions and their mechanisms as well as new experimental methods is difficult for a first year organic course and is compounded for a one semester text. This book is recommended for its judicious selection of subject matter, its simple and clear language, its attractive typography and its original illustrations of ball and stick and perspective models to teach structure and mechanism.

Among the relatively few typographical errors found were the formula  $C_5H_5M_3Br$  on page 36, the use of equilibrium instead of one double headed arrow for the resonance structures of ethylene on page 59, and elimination of hydrogen and hydroxyl from the same carbon of ethanol on page 55; the latter two errors are not made on pages 10 and 54, respectively.

The weakness of this book is the sacrifice of rigor which frequently accompanies simplification and contraction of subject matter. Thus, cyclopropane is represented on page 41 as reacting with bromine by addition and not substitution to form a 1,3-dibromopropane despite the fact that there is only 13% reaction in the dark which occurs by processes other than addition, and yields several other products. More serious is the statement on page 66 that "acetylenes are extremely reactive substances" which promotes the common undergraduate misconception that the triple bond undergoes addition more rapidly than corresponding olefins.

The opportunity to provide insight and relate organic reactions is lost because of

the superficial treatment. Thus, the statement on page 70 that the "principal difference between the chemical behavior of the acetylenes and that of the olefins... is due to the hydrogen atom bonded to an acetylenic carbon" is not accompanied by an attempt to relate this property to the orbital hybridization of these structures in previous sections. Similarly, the initial step in polar benzene monobromination is not related to that in olefin addition nor is the difference in the second step of these reactions interpreted by resonance stabilization.

These shortcomings are reflected in reaction mechanisms. The frontal approach of water as nucleophile in *t*-butyl chloride hydrolysis on page 119 is followed by the unqualified statement that "this behavior is characteristic of  $S_N1$  reactions." The addition of "hydrogen halide to an olefin, followed by hydrolysis" as "an easy route to an alcohol" is undoubtedly a consequence of presenting olefin hydration as addition of sulfuric acid followed by hydration of the sulfuric acid ester on page 137. A final example is the formation of ethyl ether from ethanol which should be presented as an  $S_N2$  attack of alcohol as nucleophile on its protonated conjugate acid or alkyl acid sulfate rather than  $S_N1$  reaction of a carbonium ion which would obtain for a *tertiary* or *secondary* alcohol.

The exercises and problems and the summaries provided at the end of each chapter are helpful for review and drill but will not challenge a very good student. The average student in a terminal one year course should enjoy the book and derive a fair knowledge of fundamental organic chemistry and this book is recommended as more than adequate for this audience.

The laboratory manual written to be used with this text is planned primarily for a one semester brief course as well as a two semester or two quarter course having one three hour laboratory per week. Like the text, it is aimed at students preparing for careers in areas other than chemistry.

Both the organization and experiments in this manual follow the conventional pattern, beginning with techniques of melting point determinations, crystallization, distillation, etc., and following these with the preparation of representative olefins, alkyl halides, carbonyl compounds, etc. by methods chosen to represent basic reaction types. There are also experiments to illustrate the properties of functional groups and some of these are used for the preparation of derivatives and the solution of unknowns.

The directions are detailed and carefully written to help the novice. Diagrams are provided for the older student equipment and taperware which is now widely used. Among newer procedures included are those for the Ritter reaction, sodium borohydride reduction of benzophenone and the preparation of benzoic anhydride from benzoyl chloride and pyridine.

The success and value of a laboratory manual for students can best be evaluated from the results obtained with students. However, it would seem to the reviewer that crystallization should avoid the

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acetanilide-water system since water is generally not a good solvent for organic compounds and acetanilide frequently melts and perplexes the student who has not added sufficient water. In the dehydration of cyclohexanol to cyclohexene, the use of a column and chaser would give a narrower boiling distillate. Finally, electrophilic substitution in benzene is more safely illustrated by a nitration or Friedel-Crafts reaction than the bromination with 40 grams of elementary bromine in the hands of a novice with a limited background in organic chemistry taking a short course.

In general, the experiments are competently chosen and presented to provide a conscientious student with an elementary understanding of the rationale and methods of organic chemical experimentation.

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### Chemistry

*Theodore P. Perros*, George Washington University, Washington, D.C. American Book Co., New York, 1967. x + 676 pp. Figs. and tables. 16.5 × 24 cm. \$8.95.

The author's prefatory remark begins, "That a course in introductory chemistry

can concurrently fill the needs of a science major and challenge the non-science major has been the author's guiding premise for this text." The reviewer agrees. The author then continues, "With supplementary readings, it may be used for honors courses." The reviewer finds the last statement to be an exaggeration.

The basic problem in this text appears to be one of balance, for there is little well chosen or well used material which would slant it toward a science major. For example, the decomposition of nitric oxide is used as an example to show that although a reaction may be thermodynamically favored, for kinetic reasons it does not occur. Following this, one would expect to see an extensive discussion of chemical kinetics, however, this does not materialize. The only discussions of kinetics are found crudely worked into the section on chemical equilibrium and in an almost irrelevant two page appendix.

A potential science major is certain also to be confused by parts of the section on chemical bonding. The valence bond approach is used exclusively, although the molecular orbital approach is mentioned frequently enough to make one wonder just what it is. Again, molecular orbital theory is treated in a two page appendix! Although no serious errors were found in the section on bonding, a student is likely to meet with difficulty in trying to read and comprehend the section on hybrid orbitals.

Gross errors were found, however, in other sections of the text. For instance, the definition of the freezing point on page 290 is really an exact definition of the

triple point. The discussions of thermodynamics are plagued by a more or less random appearance of superscript zeros (the standard state notation), when, in fact, there are specific rules governing the use of this notation.

While the textual arrangement is really a matter of personal choice, it does introduce one problem in this case. The technique and uses of titrations are discussed in Chapter 16, while the properties of solutions are found in Chapter 17, and ionic equilibrium is discussed in Chapter 18. Consequently, no explanation of how or why a titration works is given, and the author never returns to the concept again (except briefly at the end of Chapter 20, the redox chapter). This arrangement hardly seems justifiable when the text is designed to serve the needs of science majors.

The author makes frequent and enlightening use of historical data and anecdotes. While this reviewer is generally unqualified to pass judgement on the accuracy of these topics, he confesses surprise at seeing the valence bond theory attributed to Linus Pauling!

The text is not without its high points, however. Electron clouds around atoms are described as very pliable systems which can be perturbed by other atoms, ions, or charged particles. This description is alluded to many times in the text, and should provide students with some genuine insight into the effects of polarizability on the nature of the chemical bond.

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