

**AN ELEMENTARY  
TREATISE ON  
QUALITATIVE  
CHEMICAL ANALYSIS**

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An elementary treatise on qualitative chemical analysis by J. F. Sellers

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QUALITATIVE CHEMICAL  
ANALYSIS

BY

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## PREFACE

So many books on analytical chemistry are already in print that the question may be raised whether it is wise to add still another to their number; and therefore the author desires to present the following reasons which seem to him to justify the publication of the present work.

Most writers on analytical chemistry have gone either to the one or the other of two extremes. First, there are those who, like Fresenius or Prescott and Johnson, have endeavored to cover the entire field and to include the whole detail of analytical chemistry. Their works are indispensable to teachers and to students who make chemistry a specialty; but for beginners, who may not give more than one year of eight or ten hours a week to the subject, they are far too voluminous. On the other hand, there are those whose ardor for brevity has led them to the other extreme of condensing their material into "tables" and "schemes," — by which means they have magnified the empirical and have minimized the rational aspect of the subject, to its considerable detriment as a factor in liberal education.

In order to avoid either extreme the writer presents this elementary treatise having these features:—

1. A course short enough to be digested during the time allotted in an ordinary college curriculum, but at

the same time intended to magnify the scientific and pedagogical nature of analytical chemistry.

2. A course both practical and progressive, — practical, in that the student can master the methods and principles of chemical analysis, and become a practical analyst; progressive, in that the chief aim of the book is to prepare the student thoroughly for advanced university work.

3. A course selected from the most recent and approved methods recorded in the best literature and verified by actual application in the author's laboratory. Among some of the improved methods are mentioned:—

(a) Reddrop's application of normal solutions to qualitative analysis. *Chemical News*, May, 1890.

(b) Hofmann's separation of arsenic, antimony, and tin, by modification of Marsh's test. Fresenius' *Qualitative Analysis*, 1897 edition, p. 299.

(c) Parr's separation of aluminum, chromium, and iron, by means of sodium peroxide. This method commends itself for its accuracy, its briefness and simplicity, and its certainty in detecting aluminum. Other methods depending on sodium hydroxide are defective, in that the reagent itself generally contains aluminum salts; sodium peroxide, by reason of its manufacture, does not contain perceptible traces of such salts. *Journ. Amer. Chem. Soc.*, 19, p. 341.

(d) Fresenius and Ruppert's separation of barium, strontium, and calcium, by means of the differences of solubility of their nitrates in ether-alcohol. *Fres. Qual. Anal.*, p. 160.

(e) Hager's separation of chlorine, bromine, and iodine, by means of the differences of solubility of their silver salts in ammonium "sesqui" carbonate. *Fres. Qual. Anal.*, p. 378.



4. A course free, as is thought wise, from the mechanical schemes in qualitative analysis. To this end, many of the usual tables of separation are omitted, and in their place some suggestive hints are given after the list of reactions for each group. Thus the student is expected and encouraged to exercise his judgment in selecting methods of analysis.

5. A course conformable to the modern dissociation theory of solutions. For example, why is the activity of certain acids modified by adding the salts of those acids; or, more specifically, why is the solvent power of acetic acid decreased by adding some sodium acetate?

6. A course giving more than ordinary emphasis to the spectroscope. Though spectroscopy is not *chemical* analysis, it possesses superior advantages over the chemical methods in these particulars:—

(a) Methods of greater exactness and readiness of execution.

(b) Methods superior for the preliminary detection of the alkali and alkali-earth metals. This is important, especially when the alkali-earth metals are combined with phosphoric, oxalic, and hydrofluoric acids.

(c) Methods superior for detecting certain metals, which, under some conditions, are evasive; *e.g.*, aluminum, manganese, and magnesium.

It is obvious that the study of the theory of solution and of spectroscopy may either be taken up in the order of the text or reserved for the last work in the course; and also that these subjects may be omitted entirely if a very elementary course is desired. In the latter case it would be possible also to omit the discussion of the

analysis for the metals of the third group in the presence of phosphoric acid, and those portions of Part II which are printed in small type.

The discussion of solutions in the brief space available in this book is necessarily much condensed, and possibly it is somewhat abstract and uninviting; but in the author's opinion its introduction is desirable. Its purpose is to provide the student of qualitative analysis with the means for a rational interpretation of many apparently irrational reactions, and to help prepare him for the next stage of his chemical education, — namely, the study of quantitative analysis, — where the application of the laws of solutions is more abundant. No other text-book on qualitative analysis, within the author's knowledge, incorporates this dissociation theory of solution; but its adaptability to qualitative instruction is shown by the fact that during the past half decade many teachers of the subject have devoted more or less time in their lectures to the practical application of the theory.

In the preparation of this book the following literature has been consulted:—

1. Many of the smaller text-books on qualitative analysis, including Noyes's, Newth's, and Volhard and Zimmermann's.

2. Standard works on general and analytical chemistry, including Watt's *Chemical Dictionary*; Roscoe and Schorlemmer's *Treatise on Chemistry*; Mendeleeff's *Principles of Chemistry*; Ostwald's and Nernst's works on physical chemistry; Vogel's, Landaur's, and Roscoe's works on spectrum analysis; Fresenius' works — the latest editions.

3. Memoirs in American and foreign chemical journals.

Grateful acknowledgment is made to Dr. R. W. Jones of the University of Mississippi, for his painstaking criticism of the manuscript of this little book. The author learned the chemical alphabet and received much inspiration and encouragement from this excellent teacher.

Appreciative mention also is made of the following gentlemen: Dr. H. C. White of the University of Georgia, for valuable suggestions as regards the adaptability of the book to elementary college work; Dr. J. W. Mallet of the University of Virginia, Dr. J. Stieglitz of the University of Chicago, and Dr. E. Renouf of Johns Hopkins University, for opinions concerning modern theories of solution; and Mr. H. V. Jackson of Mercer University, for general assistance.

J. F. S.

MACON, GA., September, 1900

## PREFACE TO SECOND EDITION

THE more important modifications made in this edition of the book are the appending of 13 pages of reference notes (see p. 163) and tables, revision of several of the processes of separation, and correction of a number of typographical errors.

For criticism and proof reading the author is indebted to many of his friends, among whom may be mentioned Professor W. H. Emerson and Dr. G. H. Boggs of the Georgia School of Technology, Dr. J. P. Montgomery of the Mississippi Agricultural and Mechanical College, Dr. Homer V. Black of the University of Georgia, Professor C. W. Steed of Mercer University, Professor G. P. Shingler of Emory College, and Professor Alexander Smith of the University of Chicago.

J. F. S.

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