

A STUDY GUIDE *to Chemical Principles*

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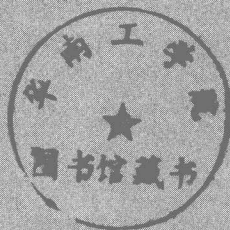
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A STUDY GUIDE TO CHEMICAL PRINCIPLES



Chemistry - Study guides

WILBERT HUTTON *Iowa State University*



PREFACE

College freshmen share a common problem: They find that college is considerably different from high school. The competition is greater, the pace and standards of education are higher, and the work is more challenging.

The organization of college courses is likely to force a student to make a major adjustment in his study habits. In high school the work is generally straightforward. Most of it is covered in classes. Homework assignments are relatively easy, and there may be fixed study periods in which to do assignments. To a large extent grades are based on tests and homework. In college, students spend only a few hours in class, aside from laboratories and quiz or recitation sessions. Thus, whether a student passes or fails depends primarily on how he performs in a few examinations. As a result, his success depends on how and what he studies.

This book has been written to assist the student in his study of general chemistry. In particular, it is a study guide to accompany the general chemistry textbook *Chemical Principles* by Richard E. Dickerson, Harry B. Gray, and Gilbert P. Haight, Jr. This text, like all general chemistry textbooks, is written to teach the student the fundamental principles and concepts upon which chemistry is based

and to help him to appreciate the importance of the science. Most general chemistry texts differ only in the order and methods used in presenting these fundamentals. For this reason, students who are taking their general chemistry from other textbooks can also be helped by this study guide.

This book follows the first six chapters of the Dickerson, Gray, and Haight text on a section-by-section basis. It points out the most important topics in each chapter and assists the student in selecting areas in which he should concentrate. When necessary, additional background on a topic is provided; this brings the student to the level of presentation in the text. The more difficult concepts are explained in detail, often by an approach different from that of the text. Additional worked-out examples and problems are provided, and a brief self-evaluation test is given for each chapter.

Also included is an introduction that provides a review of relevant mathematics, tips on how to study and how to solve problems, a section on the use of the slide rule, and appendixes supplying additional help in mathematics.

In short, the study guide attempts to provide all of the information that the student needs for comprehending the principles of chemistry. If he should require additional help, he is urged to read *Programed Reviews of Chemical Principles* by Jean D. Lassila *et al.* This book and the study guide provide the kind of background that is essential for learning chemistry.

WILBERT HUTTON

Edgartown, Massachusetts
September 1969

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PART ONE

**PRELUDE TO STUDYING
CHEMICAL PRINCIPLES**

HOW TO USE THIS STUDY GUIDE

This study guide has been written to accompany the textbook, *Chemical Principles*, by Richard E. Dickerson, Harry B. Gray, and Gilbert P. Haight, Jr. (W. A. Benjamin, Inc., New York, 1970). The purpose of the study guide is to assist the student using *Chemical Principles* in his study of general college chemistry. Since most of those who take general chemistry are freshmen, this book is addressed to them.

We realize that freshmen have different backgrounds in high school chemistry, physics, and mathematics. Some may not have studied chemistry at all in high school. Others may have had considerable experience in these sciences, and may have even completed high school courses that border on the college-level courses. This study guide has not been written to assist students in this last group. Although these students may find it helpful, it is quite likely that they will consider the text and lectures adequate to their needs, and some may regard the material in this guide too elementary and repetitious. Rather, *A Study Guide to Chemical Principles* has been written for students who can profit from a more detailed explanation of some of the more important topics than has been given to them in the text. No assumptions have been made as to the backgrounds of these students. We

hope that even those who are being exposed to chemistry for the first time will find the material helpful.

This study guide is divided into two parts. The first part includes a series of expositions on those topics which may be of general use to the student in his study of chemistry. The second part is devoted to the specific subject matter of the course at the level and in the sequence given in *Chemical Principles*.

You should survey the material in the first part so you will become familiar with its content. Some of this information may be needed later in the course; and you should be aware of what is available in case you need it. All students are advised to read the chapter, "How to Study."

The format of the second part of the book follows the first six chapters of *Chemical Principles*. With few exceptions, topics are presented section by section. They have been written with the assumption that first the student will read a chapter in the text and then read the corresponding chapter in the study guide. Ideally, both the text and the guide should be read prior to attending the lectures covering the material in the chapters. The text and lecture notes should be scrutinized to determine those topics which the lecturer has emphasized. If a concept that is the subject of a particular section in the text is not completely understood or requires elaboration, the student can find further information in the corresponding section of the study guide.

In writing the study guide, we have attempted to identify topics or concepts in each section that are the most essential to understanding material to come later in the course. We have tried to present these topics in a way that will contribute to a student's understanding and help him to apply what he has learned. When we feel that the presentation in the text presumes prior knowledge beyond that of the average student, a rather detailed development of a concept or topic is presented, beginning at a more elementary level. When a topic appears in the text which we know from experience to be especially troublesome to beginning students, the same topic is presented in the study guide, but a different approach is taken in our presentation. Often a student can learn more from one approach than from another, or he can develop a more sound understanding by comparing two different approaches to the same topic.

A brief self-evaluation quiz for each chapter is given in Appendix 4. You should use these tests to determine whether you understand some of the more important concepts.

Occasionally, a section in the text will receive very little space (sometimes none) in the study guide. In these instances, we feel either that the presentation in the text should be adequate for the average student without further explanation, or that the subject discussed in the section is not of sufficient relevance to the basic aims of the general chemistry course to warrant further discussion.

In writing *Chemical Principles*, the authors have taken an historical approach to the subject matter. The evolution of a concept is presented from its inception to its present status. As to be expected, many of the

original interpretations or theories used to explain chemical phenomena have been proved incorrect as more knowledge has been obtained. As a result, the definitions of many terms have been modified through the years until their present meaning bears little resemblance to their original meaning. This can often be a source of confusion to the student. In writing the study guide, the historical aspects of the presentation in the text have been considered to be of importance only as background. Emphasis is placed on concepts and terms as they are used currently.

The student should also realize that the authors of *Chemical Principles* believe that a subject can best be learned if it is repeated at intervals during a course rather than presented as a complete unit in one section or chapter of the text. Their approach is to introduce a subject early, expand on it in one or more subsequent chapters, and perhaps apply it with rigor still later in the text. As a result, a student may find himself spending an unwarranted amount of his study time attempting to understand a particular topic in depth at a time in the course when such a deep understanding is not expected and for which he is not equipped to understand it adequately. In this study guide, an effort is made to indicate which topics will be presented later and to supply guidelines that the student can use to measure the depth of understanding he will need for a particular topic when it appears in the text.

Much of your learning in college is the product of how you apply yourself to your studies outside of the classroom. This study guide is just one part of a teaching system that has been provided by W. A. Benjamin, Inc., to accompany the textbook. The objective in supplying this system is to make available to the student all the resources he might need to enable him to gain as much as possible from his independent study. We recognize that some students will need more assistance in this effort than others.

The textbook is, of course, the core of the teaching system. As mentioned, *A Study Guide to Chemical Principles* complements the text with additional background material, more detailed explanations, and provides guidelines that the student can use to direct his studies. Most students taking a general chemistry course should be able to put the study guide to good use.

For those students whose high school chemistry background has been deficient in some areas that are important in the course, *Programed Reviews of Chemical Principles*, by Jean D. Lassilla *et al.*, should be consulted. This book contains a series of self-instructional problems that begin with "first principles" and progress to the level of the text. The programs treat specific subjects and are keyed to the chapters in *Chemical Principles*. Those students who have average to below average backgrounds and ability in chemistry will find Dr. Lassilla's programed reviews to be a valuable addition to their study resources.

Since problem-solving is of utmost importance in chemistry, a third part of the teaching system is the book *Relevant Problems for Chemical Principles*, by Ian S. Butler and Arthur E. Grosser. This book is also arranged according to the sequence of subject matter presented in

Chemical Principles. The book contains a series of extremely interesting and relevant problems to supplement those given in the text. A unique feature of this book is that detailed solutions are provided for every problem. Mistakes that students are likely to make in solving the problems are also pointed out and analyzed. On the whole, the problems are a bit more demanding of the student than those in the textbook. Certainly, a student who incorporates the solution of these problems in his study program should be well equipped to handle any problems that occur on examinations. The student who has already had a rather extensive high school science background should find this book a stimulating and instructional teaching supplement.

HOW TO STUDY

Basic to your ability to learn is your ability to study effectively and efficiently. Since the objective of this study guide is to assist you with your studies in chemistry, it is appropriate to begin with a few comments on how to study.

Most freshmen have taken their ability to study for granted. Any difficulty they may have with their course work is usually attributed to difficult subject matter, poor background, poor teaching, crowded classroom facilities, noisy dormitory surroundings, and the like. These complaints may or may not be legitimate. Even if they do exist, they can be minimized and overcome by proper study habits. More often than not, these complaints arise because of a student's inability to study effectively.

It is not our purpose here to present a detailed and exhaustive analysis of techniques for effective study. Fortunately, there are a number of books available that treat this subject in considerable detail.¹ Unfortunately, few students consult such material unless it is presented as a required reading assignment or if in some other way they are coerced into giving this aspect of their training the attention that it deserves.

¹ See, for example, the short paperback, *How to Study*, by C. T. Morgan and J. Deese, 2nd ed., McGraw-Hill, New York, 1969.