AHANDBOOK FOR THE TECHNICAL AND SCIENTIFIC SECRETARY

GEORGE
FREEDMAN

A HANDBOOK FOR THE TECHNICAL AND SCIENTIFIC SECRETARY

GEORGE FREEDMAN

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Manufactured in the United States of America Dover Publications, Inc. 180 Varick Street New York, N.Y. 10014 Dedicated (in alphabetical order) to the ladies who in the last twenty years have somehow survived the ordeal of being my secretary:

Anne Arlene Betty Carolyn Gertrude (2) Janet Jeannine Jeannette Joanne Kathy Linda Louise Marjorie Marion Marilyn Mary (3) Nancy Peggy Rosella

Preface

This book is designed to help the secretary who works for a scientist or an engineer. Its goal is to serve as a guide for improving the quality of her work, and, incidentally, to increase the pleasure she may derive from it. At the same time, if it is successful, it will also satisfy and give pleasure to another person, the engineer or scientist for whom she works. This book differs from most guides to the secretary in that it is written by one who has never been a secretary and never expects to be one. I have been and am the employer of a secretary, and see her from the employer's point of view. Since I am the one to be satisfied by what she does, I consider myself well suited to write a handbook for her. So, without any apologies, I wrote it, and here it is.

This book is based on the premise, in which I sincerely believe, that a secretary can always do a better job when she understands what she is doing than when she doesn't. Does this mean that the secretary to a chemist should know chemistry? Well, she is his closest working associate; it would certainly help for her to know some. If a secretary is typing mathematical or chemical equations all day, and many secretaries do, she is usually working with what is for her meaningless gibberish. That is a terrible predicament to be in, and a terrible way to earn a living. But, it is really not difficult to explain what a mathematical or chemical equation is to one who has the level of intelligence required to be a good secretary. Anyone who has the ability to type and take shorthand and organize complex reports and handle people and the telephone in a busy office (usually with a level of tact and skill that puts most Ph.D.'s to shame) is quite capable of understanding, for example, that a chemical equation is merely a shorthand way of telling how certain materials combine to form other materials. Once the chemical equation takes on that meaning, it loses many of the qualities of gibberish. So, early in my engineering career I began the policy of explaining to my secretaries just enough of what the material they would have to handle was about so that it would have some

meaning and interest for them. This method always seems to have worked; that is, it always seems to have helped both my secretaries and me.

The material in this book is presented in two parts. This first part is a treatment, in "secretarial" language, of the basic scientific disciplines of chemistry, mathematics, and physics, and there is also a chapter on electricity and electronics. Throughout, I have tried to keep in mind that only "enough" would be given, so the secretary would not feel overwhelmed by complex details involving unfamiliar subject matter. Every topic is treated from the point of view of how the material should be composed on a typewriter. Many times the statement is made, "this is how he will say it (into a dictating machine or in 'live' dictation), and this is how you will write it."

The second part of the book is meant to serve both as a guide to some secretarial techniques and as a reference. The techniques covered are ones that are necessary to the effective performance of a technical secretary, but which are not normally included in her training. Primary among these is the use of drafting tools for making simple sketches and graphs. Since I believe that the best guide to effective performance is provided by examples, a generous number of these, in a variety of technical fields, is given. The remaining portion of Part II consists of a set of glossaries that the secretary will be able to use as a supplement to her dictionary, as swift, easy-to-understand references. The glossaries contain prefixes, suffixes, abbreviations, names of important scientists, some foreign alphabets, and, most important, a dictionary of technical terms, with definitions given in as few words as possible. Defining naphthalene as "a chemical compound" may be very incomplete for the scientist, but, in most cases, it is all his secretary needs to know to do her job.

I think that it is also worth saying a word about what is *not* in this book: First, whatever the secretary should know *anyway* has been left out. There is no advice on what to wear to the office or how to file or get plane tickets or deal with visitors or keep reminder notes. I am sure that a secretary can handle these matters far better without my recommendations than with them. Also, I have made no attempt to treat every field of science and engineering. An understanding of the basic physical sciences should help the secretary with most fields. Also, in line with the philosophy of not treating what is not understood, the biological sciences are not covered since I have never studied them.

I would like to acknowledge the patient and tolerant aid of my wife who has made many helpful suggestions in our discussions

of the material, and has helped me greatly with the choice of words and manner of presentation. I also wish to acknowledge the kind aid and comments given by the many secretaries of the Raytheon Company of Lexington, Massachusetts, who have subjected the book to prepublication tryouts. Many of the examples of typical typed pages in the various fields of chemistry, mathematics, physics, and electronics that appear within the text are extracts from actual technical reports written by engineers and scientists employed by the Raytheon Company (and typed by their secretaries). The company's permission to use this material is gratefully appreciated.

George Freedman

Wayland, Massachusetts June, 1967

To the Secretary How to Use This Book

The best way to use this book is first to read Part I from the beginning to the end. Then repeat the process for the material that relates most closely to the work being done in your office. By the time you have gone through a portion of the text for the second time you should have very little difficulty with it. If anything still remains unclear, any scientist or engineer in the group for which you work should be able to help, and most will be glad to.

Regardless of what kind of office you work in, you should give particular attention to the chapters on mathematics and physics. No matter what your employer's specialty is, he will always use the language of mathematics and physics. If chemistry is completely missing from your place of work, you might omit the chapter on chemistry. By the same token, you might leave out the chapter on electricity and electronics if these subjects are not discussed in your office. But, this book will really serve you best if you read all four chapters in Part I. It is inevitable that an electronics engineer will sometime in his career find himself talking about chemicals, and eventually even a theoretical physicist will discuss electronics. Notice that each section is followed by a short summary which can help you review the most important concepts covered in that section (or give you an idea of what is included in a section you may have skipped).

Just reading the chapters in Part I is not enough, however. You must also do some practicing. Look over some of the memos and reports that you have worked on in the past. Compare the way you presented the material with what is suggested here. Retype some of the crucial sections, making corrections and changes in accordance with your newly acquired knowledge. Always keep in mind the two bits of advice that you will meet over and over again in this book: plan a page so that it is neat and pleasing to look at, and use your common sense. Now you will also be able to read over the text of the memo or report to get its meaning (not its detailed, exact, scientific meaning, but the general drift

of what it says). This rereading will enable you to catch many small errors that you would not have been able to see before.

Part II of this book is for reference. Become familiar with the seven glossaries and develop the habit of referring to them. Glossary 7, which contains short definitions of scientific and engineering terms, should help you clear up many problems you may have about the meaning, spelling, or pronunciation of unfamiliar words.

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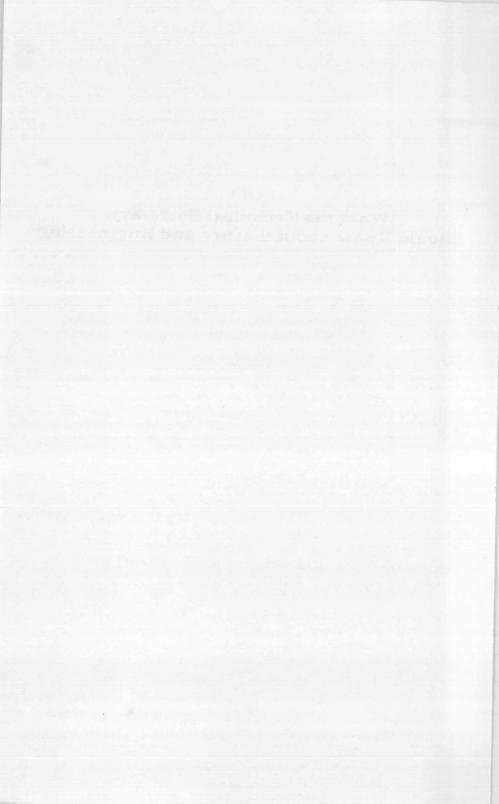
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Part I

What the Technical Secretary Should Know about Science and Engineering



Chapter 1 Chemistry

Introduction

In spite of what you may have heard, it is difficult to tell a chemist from other people. It is even difficult to tell a chemical office from, let us say, an insurance office. This is so because the chemist's fuming test tubes are usually far down the hall, in the "lab" or the "distillation room" or some such place. The office looks like any other. But if you work for a chemist the material you will work with will be very different from what you would see in an insurance office. Every business and profession has its own specialized terminology, its "jargon," with which the secretary must become familiar. Suppose you have just accepted a job working for the engineering department of a chemical company. Your new employer calls you into his office on your first day of work. Your pad and pencil are ready. He dictates: "After the reaction proceeded to completion the resulting precipitate was desiccated, oxidized to a higher valence state, and caused to sublime by placing it in an autoclave...." This is a chemist's special language. It is neither foreign nor difficult, only different from what you have been accustomed to. However, with a few new rules of grammar and a growing new vocabulary you will find the chemical work both fascinating and

This chapter approaches "chemistry for the secretary" in six major sections. Each section contains explanatory text, some examples, and a short summary. You may find the summaries to be all that you need, or you may decide to skip a section entirely because your employer never deals with that branch of chemistry. This is quite all right. Just be sure you make a mental note of the section you left out so that you can refer to it if you ever do need it.

The Chemical Elements

What Is an Element? Every material in the world, solid, liquid, or gas, is a chemical. How many chemicals or different materials do we know about? Millions. It is the job of the chemist to

know about them: how to make them, how to "unmake" them, and how to make them into other materials. He can know all this because these millions of materials are only different combinations of about one hundred basic building blocks, or *elements*. In a similar manner the thousands of words in the English language are made up of only twenty-six letters (or elements).

Some chemical elements are named after men (columbium, einsteinium, fermium, lawrencium, mendelevium), places (europium, germanium, americium, francium, polonium, californium, berkelium), mythical gods (mercury, uranium, neptunium, promethium, thorium), and so on. Some names are descriptive, for example, tungsten comes from the Swedish tung (heavy) and sten (stone); and the name radium was chosen by Madame Curie (who discovered it) to indicate that the material gives off a great deal of nuclear radiation. Some elements have two names; for example, tungsten is also known as wolfram after the mineral from which it is refined, wolframite. Some have two spellings: aluminum in the United States and aluminium in the British Empire. More than half end in -um or -ium.

Some elements are found in greater quantities than others. One reason we build automobiles out of the chemical element iron rather than the chemical element platinum is that there is much more iron in the world than platinum. For the same reason, statues are more usually made of bronze (an alloy of the elements copper and tin) than of another metal which is also yellow, gold. If the elements of the world were made into a pie

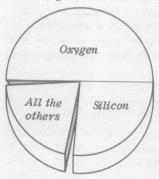


Figure 1. The chemical elements.

with a slice for each element proportional to the amount of that element, then the whole arrangement would look like Figure 1. One element, oxygen, makes up about half of the earth and another element, silicon, makes up about another quarter. This should not be surprising if you think about it, since most of the world is rocky and sandy, and rock and sand are just chemical combinations of silicon and oxygen. (There is certainly a great deal of rock and sand in such places as the Himalayan Mountains and the

Sahara Desert.) This leaves about a quarter of the earth available for more interesting things, to which we will now turn. Abbreviations for the Chemical Elements. The names of the chemical elements are simply nouns and as such are commonly

written as ordinary words, *without* capitalization. However, when it is desired to represent them in short form, they are symbolized in a rigidly prescribed manner by abbreviations consisting of either one or two letters. At all times the first letter is capitalized and if there is a second letter it is *never* capitalized. Thus,

aluminum is written Al calcium is written Ca oxygen is written O hydrogen is written H

Do not be fooled into always using the first letter of an element's name to represent it, however. For example, silver is neither Si nor S but rather Ag (Si is silicon and S is sulfur). Furthermore, tungsten is written W, and antimony is written Sb. A list of all the elements with their symbols is given in Glossary 4, in Part II, p. 208.

The Atom. An atom is simply the smallest unit of an element that can exist and still have enough personality to be recognized as the element it is. One might call an atom the "elemental" part of the element. Just as there are about a hundred different kinds of elements, so there are necessarily only about a hundred different kinds of atoms, one kind for each element.

We often talk of "an atom of carbon," or use a sentence like, "One atom of carbon combines with two atoms of oxygen to form carbon dioxide." Atom comes from a Greek word meaning "indivisible." Thus, if you had a piece of iron and you cut it in half, threw one half away, cut the remaining piece in half, and repeated and repeated this process thousands of times, soon the remaining piece of iron could be seen only with a powerful microscope. After that it would be too small to be seen even in that way. Ultimately, assuming your cutting apparatus could reach the end (not of its ability to cut, but of the capacity of the iron to be further subdivided), the smallest particle of iron remaining, one which could not possibly be subdivided, would be the iron atom.

Summary

All the materials of the world, whether solids, liquids, or gases, are made up either of pure chemical elements or of combinations of chemical elements.

^{2.} There are only about a hundred different chemical elements: iron, chlorine, copper, zinc, nitrogen, helium, carbon, hydrogen, uranium, and about ninety-one more.

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- 3. The atom is the smallest amount of a recognizable element that can exist. It is extremely small. If you have a diamond ring that weighs one carat; it has approximately a thousand million billion atoms of carbon in it.
- 4. Each of the elements has its own prescribed abbreviation consisting of one or two letters. The first letter of the abbreviation is always capitalized, but if there is a second letter it is never capitalized. Refer to the list in Glossary 4 (p. 208) to find the correct abbreviation for each element.

Chemical Combinations

Compounds and Molecules. If you associate with chemists you will one day hear the expression, "cookbook chemist." It will be applied to someone—a chemist—in a disparaging way. We should pay a little attention to this term, however, because it is pertinent to the subject of this section. The fact is that cooking is chemistry. In cooking, chemical materials (the recipe ingredients) are mixed together; chemical processes occur; and these processes are speeded up by the application of heat. In the end out of the oven appear some different materials, which are call by such unchemical names as cake, stew, and beef stroganoff. What is wrong with being a "cookbook chemist"? Nothing, really, except that most chemists want to write their own cookbooks and recipes and not just follow the directions of another chemist-cook. The chemist who is content to follow the procedures set up by others has his value too, but he is the "cookbook chemist."

Now what happens when the cook, housewife or chemist, cooks? Atoms (or groups of atoms) combine with each other to form new groups of atoms. The finished product is known as a *compound*. Webster says that "a compound is a distinct substance formed by a union of two or more ingredients in definite proportions by weight." That is a straightforward enough definition for either chemist or secretary.

In our everyday lives we do not see uncombined elements very often. This is so because most elements have a tendency to combine with each other. In the natural course of events over the passage of history, most elements have already entered into some kind of combination with other elements. The chemist can sometimes "uncombine" them and recombine them into new materials. By such procedures the chemist has created materials such as nylon, gasoline, plastic, glue, and the fluorescent material that glows in a fluorescent bulb or television tube. Nature