

Introduction



You've passed the first hurdle in understanding a little about chemistry: You've picked up this book. I imagine that a large number of people looked at the title, saw the word *chemistry*, and bypassed it like it was covered in germs.

I don't know how many times I've been on vacation and struck up a conversation with someone, and the dreaded question is asked: "What do you do?"

"I'm a teacher," I reply.

"Really? And what do you teach?"

I steel myself, grit my teeth, and say in my most pleasant voice, "Chemistry."

I see The Expression, followed by, "Oh, I never took chemistry. It was too hard." Or "You must be smart to teach chemistry." Or "Goodbye!"

I think a lot of people feel this way because they think that chemistry is too abstract, too mathematical, too removed from their real lives. But in one way or another, all of us do chemistry.

Remember as a child making that baking soda and vinegar volcano? That's chemistry. Do you cook or clean or use fingernail polish remover? All of that is chemistry. I never had a chemistry set as a child, but I always loved science. My high school chemistry teacher was a great biology teacher but really didn't know much chemistry. But when I took my first chemistry course in college, the labs hooked me. I enjoyed seeing the colors of the solids coming out of solutions. I enjoyed *synthesis*, making new compounds. The idea of making something nobody else had ever made before fascinated me. I wanted to work for a chemical company, doing research, but then I discovered my second love: teaching.

Chemistry is sometimes called the central science (mostly by chemists) because to have a good understanding of biology or geology or even physics, you must have a good understanding of chemistry. Ours is a chemical world, and I hope that you enjoy discovering the chemical nature of it — and that afterward, you won't find the word *chemistry* so frightening.

About This Book

My goal with this book is not to make you into a chemistry major. My goal is simply to give you a basic understanding of some chemical topics that commonly appear in high school or college introductory chemistry courses. If you're taking a course, use this book as a reference in conjunction with your notes and textbook.

Simply watching people play tennis, no matter how intently you watch them, will not make you a tennis star. You need to practice. And the same is true with chemistry. It's *not* a spectator sport. If you're taking a chemistry course, then you need to practice and work on problems. I show you how to work certain types of problems — gas laws, for example — but use your textbook for practice problems. It's work, yes, but it really can be fun.

How to Use This Book

I've arranged this book's content in a logical (at least to me) progression of topics. But this doesn't mean you have to start at the beginning and read to the end of the book. I've made each chapter self-contained, so feel free to skip around. Sometimes, though, you'll get a better understanding if you do a quick scan of a background section as you're reading. To help you find appropriate background sections, I've placed "see Chapter XX for more information" cross-references here and there throughout the book.

Because I'm a firm believer in concrete examples, I've also included lots of illustrations and figures with the text. They really help in the understanding of chemistry topics. And to help you with the math, I've broken up problems into steps so that it's easy to follow exactly what I'm doing.

I've kept the material to the bare bones, but I've included a few sidebars. They're interesting reading (at least to me) but not really necessary for understanding the topic at hand, so feel free to skip them. This is *your* book; use it any way you want.

Assumptions (And You Know What They Say about Assumptions!)

I really don't know why you bought this book (or will buy it — in fact, if you're still in the bookstore and *haven't* bought it yet, buy two and give one as a gift), but I assume that you're taking (or retaking) a chemistry course or preparing to take a chemistry course. I also assume that you feel relatively

comfortable with arithmetic and know enough algebra to solve for a single unknown in an equation. And I assume that you have a scientific calculator capable of doing exponents and logarithms.

And if you're buying this book just for the thrill of finding out about something different — with no plan of ever taking a chemistry course — I applaud you and hope that you enjoy this adventure.

How This Book Is Organized

I've organized the topics in a logical progression — basically the same way I organize my courses for non-science and elementary education majors. I've included a couple chapters on environmental chemistry — air and water pollution — because those topics appear so often in the news. And I've included some material in appendixes that I think might help you — especially Appendix C on the unit conversion method of working problems.

Following is an overview of each part of the book.

Part I: Basic Concepts of Chemistry

In this part, I introduce you to the really basic concepts of chemistry. I define chemistry and show you where it fits among the other sciences (in the center, naturally). I show you the chemical world around you and explain why chemistry should be important to you. I also show you the three states of matter and talk about going from one state to another — and the energy changes that occur.

Besides covering the macroscopic world of things like melting ice, I cover the microscopic world of atoms. I explain the particles that make up the atom — protons, neutrons, and electrons — and show you where they're located in the atom.

I discuss how to use the Periodic Table, an indispensable tool for chemists. And I introduce you to the atomic nucleus, which includes discussions about radioactivity, carbon-14 dating, fission and fusion nuclear reactors, and even cold fusion. You'll be absolutely *glowing* after reading this stuff.

Part II: Blessed Be the Bonds That Tie

In this part, you get into some really good stuff: bonding. I show you how table salt is made in Chapter 6, which covers ionic bonding, and I show you the covalent bonding of water in Chapter 7. I explain how to name some ionic

compounds and how to draw Lewis structural formulas of some covalent ones. I even show you what some of the molecules look like. (Rest assured that I define all these techno-buzzwords on the spot, too.)

I also talk about chemical reactions in this part. I give some examples of the different kinds of chemical reactions you may encounter and show you how to balance them. (You really didn't think I could resist that, did you?) I cover factors that affect the speed of reactions and why chemists rarely get as much product formed as expected. And I discuss electron transfer in the redox reactions involved in electroplating and flashlight batteries. I hope that you'll see the light in this part!

Part III: The Mole: The Chemist's Best Friend

In this part, I introduce the mole concept. Odd name, yes. But the mole is central to your understanding of chemical calculations. It enables you to figure the amount of reactants needed in chemical reactions and the amount of product formed. I also talk about solutions and how to calculate their concentrations. And I explain why I leave the antifreeze in my radiator during the summer and why I add rock salt to the ice when I'm making ice cream.

In addition, I give you the sour and bitter details about acids, bases, pHs, and antacids. And I present the properties of gases. In fact, in the gas chapter, you'll see so many gas laws (Boyle's Law, Charles' Law, Gay-Lussac's Law, the Combined Gas Law, the Ideal Gas Law, Avogadro's Law, and more) that you might feel like a lawyer when you're done.

Part IV: Chemistry in Everyday Life: Benefits and Problems

In this part, I show you the chemistry of carbon, called *organic chemistry*. I spend some time talking about hydrocarbons because they're so important in our society as a source of energy, and I introduce you to some organic functional groups. In Chapter 15, I show you a practical application of organic chemistry — the refining of petroleum into gasoline. In Chapter 16, I show you how that same petroleum can be used in the synthesis of polymers. I cover some of the different types of polymers, how they're made, and how they're used.

In this part, I also show you a familiar chemistry lab — the home — and tell you about cleaners, detergents, antiperspirants, cosmetics, hair-care products, and medicines. And I discuss some of the problems society faces due to the industrial nature of our world: air and water pollution. I hope that you don't get lost in the smog!

Part V: The Part of Tens

In this part, I introduce you to ten great serendipitous chemical discoveries, ten great chemistry nerds (nerds rule!), and ten useful chemistry Internet sites. I started to put in my ten favorite chemistry songs, but I could only think of nine. Bummer.

I also include some appendixes that can give you help when dealing with mathematical problems. I cover scientific units, how to handle really big or small numbers, a handy unit conversion method, and how to report answers using what are called *significant figures*.

Icons Used in This Book

If you've read other *For Dummies* books, you'll recognize the icons used in this book, but here's the quickie lowdown for those of you who aren't familiar with them:



This icon gives you a tip on the quickest, easiest way to perform a task or conquer a concept. This icon highlights stuff that's good to know and stuff that'll save you time and/or frustration.



The Remember icon is a memory jog for those really important things you shouldn't forget.



I use this icon when safety in doing a particular activity, especially mixing chemicals, is described.



I don't use this icon very much because I've kept the content pretty basic. But in those cases where I've expanded on a topic beyond the basics, I warn you with this icon. You can safely skip this material, but you may want to look at it if you're interested in a more in-depth description.

Where to Go from Here

That's really up to you and your prior knowledge. If you're trying to clarify something specific, go right to that chapter and section. If you're a real novice, start with Chapter 1 and go from there. If you know a little chemistry, I suggest reviewing Chapter 3 and then going on to Part II. Chapter 10 on the mole is essential, and so is Chapter 13 on gases.

If you're just interested in knowing about chemistry in your everyday life, read Chapter 1 and then skip to Chapters 16 and 17. If you're most interested in environmental chemistry, go on to Chapters 18 and 19. You really can't go wrong. I hope that you enjoy your chemistry trip.