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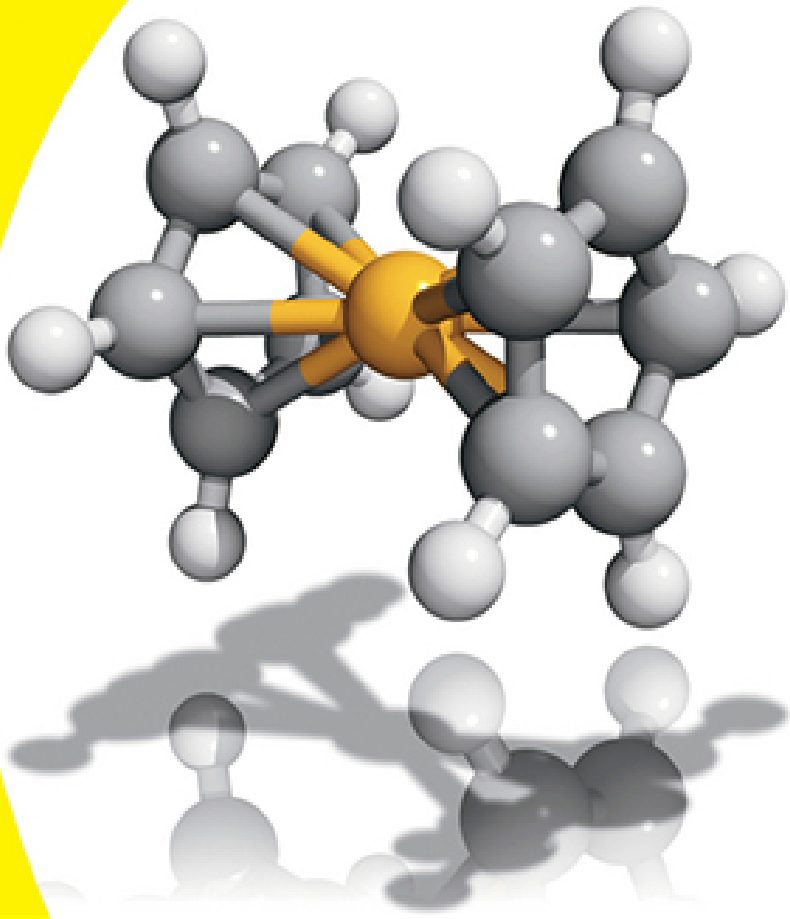

Michael L. Matson
Assistant Professor of Chemistry, University of Houston-Downtown

Alvin W. Orbaek
Rice University, Houston, Texas

Inorganic Chemistry FOR DUMMIES

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by Michael L. Matson and Alvin W. Orbaek

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About the Authors

Michael L. Matson started studying chemistry at the U.S. Naval Academy in Annapolis, Maryland. After leaving the Navy, Michael started a PhD program at Rice University, studying the use of carbon nanotubes for medical diagnosis and treatment of cancer. Specifically, Michael focused on internalizing radioactive metal ions within carbon nanotubes: Some radioactive metals could be pictured with special cameras for diagnosis, whereas others were so powerful they could kill cells for treatment. It was at Rice that Michael and Alvin met. Following Rice, Michael went to the University of Houston-Downtown to begin a tenure-track professorship. Happily married to a woman he first met in seventh grade, Michael has two young children, a yellow Labrador retriever named Flounder, is a volunteer firefighter and sommelier, and enjoys CrossFitting.

Alvin W. Orbaek was introduced to chemistry at Rice University (Houston, Texas) by way of nanotechnology, where he studied single-walled carbon nanotubes, transition metal catalysts, and silver nanoparticles. He had previously received a degree in Experimental Physics from N.U.I. Galway (Ireland) and moved into the study of space science and technology at the International Space University (Strasbourg, France). He received a position on Galactic Suite, an orbiting space hotel. To date, he enjoys life by sailing, snowboarding, and DJing. He has been spinning vinyl records since the Atlantic Hotel used to rave, and the sun would set in Ibiza. He hopes to empower people through education and technology, to that effect he is currently completing a PhD in Chemistry at Rice University.

Dedications

Michael: To my wife, Samantha.

Alvin: To Declan, Ann Gitte, Anton, Anna-livia, and Bedstemor.

Authors' Acknowledgments

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Inorganic Chemistry For Dummies®

Visit www.dummies.com/cheatsheet/inorganicchemistry to view this book's cheat sheet.

Table of Contents

Introduction

Inorganic chemistry deals with all the atoms on the periodic table, the various rules that govern how they look, and how they interact. At first glance, trying to understand the differences among 112 atoms might seem like a mammoth task. But because of the periodic table, we can bunch them up into groups and periods and make them much easier to grasp.

So welcome to *Inorganic Chemistry For Dummies*. We hope that through this book you come to learn a great deal about the environment around you, what materials you use on a regular basis, and why some materials are more important to us than others. This book is fun and informative, while at the same time insightful and descriptive. And it's designed to make this fascinating and practical science accessible to anyone, from the novice chemist to the mad scientist.

About This Book

This book was written in such a way that you can start in any chapter you choose, in the chapter that interests you the most, without having to read all the chapters before it. But the chapters build on material from one chapter to the next, so if you feel more background would help you, feel free to start with Chapter 1. You can also make use of the numerous cross references in each chapter to find pertinent information. But it can also be read like a study guide to help a student understand some of the more complicated aspect of this fascinating science.

We tried to make the information as accessible as possible. Each chapter is broken down into bite-sized

chunks that make it easy for you to quickly digest and understand the material presented. Some of the chunks are further broken down into subsections when there's special need to elaborate further on the concepts being discussed.

Science is a process that requires lots of imagination. It requires more imagination than memory, especially as you start to learn more and more about a certain topic. To help with your imagination we have tried to include helpful graphics and artwork that complement the writing within the text. Further to this we include many real-world examples and interesting historical or scientific tidbits to keep your curiosity piqued.

Conventions Used in This Book

Science progressed more rapidly in the last 200 years than it had in the few thousand years previous. A great deal of this success came from the agreement among scientist to create and use a set of standard conventions. The two most important conventions are the periodic table and the international system of units, called SI units. SI units are based on the metric system, and it's more common to see temperature expressed as Celsius than Fahrenheit. And you see lengths expressed in meters instead of inches and feet. Weights and mass are expressed in terms of grams instead of pounds or stone.

And the following conventions throughout this text make everything consistent and easy to understand:

- All Web addresses appear in `monofont`.
- New and key terms appear in *italics* and are closely followed by an easy-to-understand definition.

- **Bold** text highlights the action part of numbered steps.

What You Don’t Need to Read

Sidebars are highlighted in gray-shaded boxes so they’re easy to pick out. They contain fun facts and curious asides, but none of their information is crucial to your understanding of inorganic chemistry. Feel free to just skip over them if you prefer.

Foolish Assumptions

As authors of *Inorganic Chemistry For Dummies* we may have made a few foolish assumptions about the readership. We assume that you have very little background in chemistry, and possibly none at all; that you’re new to inorganic chemistry, and maybe you have never heard of the subject before. We assume that you know what chemistry is, but not much more than that. This book begins with all the general chemistry info that you need to grasp the concepts and material in the rest of the book. If you have some understanding of general chemistry, however, all the better.

You may be a medical student who needs to brush up in inorganic chemistry, or a high school student getting ready for a science fair, or even a freshman or junior at college. We’ve tailored this book to meet all your needs, and we sincerely hope you find great explanations about the concepts presented that are also engaging, interesting, and useful.

When you finish reading this book and your interest in chemistry is heightened, we recommend that you go to a local bookseller (second-hand book stores are a personal favorite) and find more books that offer other perspectives on inorganic chemistry. There are also excellent resources on the Internet, and many schools make class notes available online. But the best way to get involved in chemistry is by doing it. Chemistry is a fun and exciting field, made evident when you conduct chemistry experiments. Keep an eye out for demonstration kits that enable you to do your own experiments at home. And note that the last chapter of this book offers ten really cool experiments, too.

How This Book Is Organized

This book is organized into multiple parts that group topics together in the most logical way possible. Here's a brief description of each section of *Inorganic Chemistry For Dummies*:

Part I: Reviewing Some General Chemistry

Here you are introduced to science in general, and we give you the basic tenets of general chemistry that help you throughout the rest of the book.

In Chapter 1, you start with an introduction to inorganic chemistry, what it is, and why it is important. You learn how it's different from organic chemistry and how this difference is important for technology and society.

The following chapters of this section deal with topics that are covered in many general chemistry textbooks,

but these chapters cover the topics in greater detail than a general chemistry textbook. In Chapter 2 we explain what the atom looks like, how it's structured, and why this is important for inorganic chemistry. In particular, this chapter delves into the periodic table and how the structure of the atom is described. Chapter 3 introduces oxidation and reduction chemistry that helps you understand why many chemical reactions take place. It deals with the electrons that each atom has and how the electrons can be shuttled around from atom to atom. Then in Chapter 4 we focus on the nucleus and how changes to the nucleus lead to nuclear chemistry. And finally we end this section by talking about acid-base chemistry because this can help you understand the many ways in which atoms and molecules interact with one another.

Part II: Rules of Attraction: Chemical Bonding

In this section we talk about the various ways that atoms can bond with one another. In Chapter 6 we introduce covalent bonding. Chapter 7 deals with molecular symmetry, not just for inorganic chemistry but also fundamental to many of the physical sciences. Ionic and metallic bonding are detailed in Chapter 8.

Chapter 9, like all of the chapters, can be read as a standalone chapter, but it's much easier to understand if you read through the three preceding chapters. If you get stuck on coordination complexes, however, refer back to the previous three chapters for a little background information.

Part III: It's Elemental: Dining at the Periodic Table