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Physics II

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Steven Holzner, PhD
Author of Physics For Dummies

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by Steven Holzner, PhD

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Steven Holzner taught Physics at Cornell University for more than a decade, teaching thousands of students. He's the award-winning author of many books, including *Physics For Dummies, Quantum Physics For Dummies,* and *Differential Equations For Dummies,* plus *For Dummies* workbooks for all three titles. He did his undergraduate work at MIT and got his PhD from Cornell, and he has been on the faculty of both MIT and Cornell.

Dedication

To Nancy, of course.

Author's Acknowledgments

The book you hold in your hands is the product of many people's work. I'd particularly like to thank Acquisitions Editor Tracy Boggier, Senior Project Editor Alissa Schwipps, Senior Copy Editor Danielle Voirol, Technical Editors Laurie Fuhr and Ron Reifenberger, and the many talented folks in Composition Services.

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Contents at a Glance

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Introduction

For many people, physics holds a lot of terror. And Physics II courses do introduce a lot of mind-blowing concepts, such as the ideas that mass and energy are aspects of the same thing, that light is just a mix of electric and magnetic fields, and that every electron zipping around an atom creates a miniature magnet. In Physics II, charges jump, light bends, and time stretches — and not just because your instructor lost the class halfway through the lecture. Throw some math into the mix, and physics seems to get the upper hand all too often. And that's a shame, because physics isn't your enemy — it's your ally.

The ideas may have come from Albert Einstein and other people who managed to get laws and constants and units of measurement named after them, but you don't have to be a genius to understand Physics II. After all, it's only partially rocket science — and those are ultra-cool, nearing-the-speed-of-light rockets.

Many breakthroughs in the field came from students, researchers, and others who were simply curious about their world, who did experiments that often didn't turn out as expected. In this book, I introduce you to some of their discoveries, break down the math that describes their results, and give you some insight into how things work — as physicists understand it.

About This Book

Physics II For Dummies is for the inquiring mind. It's meant to explain hundreds of phenomena that you can observe all around you. For example, how does polarized light really work? Was Einstein really right about time dilation at high speeds? Why do the electromagnets in electric motors generate magnetism? And if someone hands you a gram of radioactive material with a half-life of 22,000 years, should you panic?

To study physics is to study the world. *Your* world. That's the kind of perspective I take in this book. Here, I try to relate physics to your life, not the other way around. So in the upcoming chapters, you see how telescopes and microscopes work, and you find out what makes a properly cut diamond so

brilliant. You discover how radio antennas pick up signals and how magnets make motors run. You see just how fast light and sound can travel, and you get an idea of what it really means for something to go radioactive.

When you understand the concepts, you see that the math in physics isn't just a parade of dreadful word problems; it's a way to tie real-world measurements to all that theory. Rest assured that I've kept the math in this book relatively simple — the equations don't require any knowledge beyond algebra and trigonometry.

Physics II For Dummies picks up where a Physics I course leaves off — after covering laws of motion, forces, energy, and thermodynamics. Physics I and Physics II classes have some overlap, so you do find info on electricity and magnetism in both this book and in *Physics For Dummies.* But in *Physics II For Dummies,* I cover these topics in more depth.

A great thing about this book is that *you* decide where to start and what to read. It's a reference you can jump into and out of at will. Just head to the table of contents or the index to find the information you want.

Conventions Used in This Book

Some books have a dozen stupefying conventions that you need to know before you can start reading. Not this book. All you need to know is the following:

- New terms are given in italics, like *this,* and are followed by a definition.
- Variables, like *m* for *mass,* are in italics. If you see a letter or abbreviation in a calculation and it isn't italicized, you're looking at a unit of measurement; for instance, 2.0 m is 2.0 meters.
- Vectors — those items that have both a magnitude and a direction — are given in bold, like this: ***B.***

And those are all the conventions you need to know!

What You're Not to Read

Besides the main text of the book, I've included some extra little elements that you may find enlightening or interesting: sidebars and paragraphs marked with Technical Stuff icons. The sidebars appear in shaded gray