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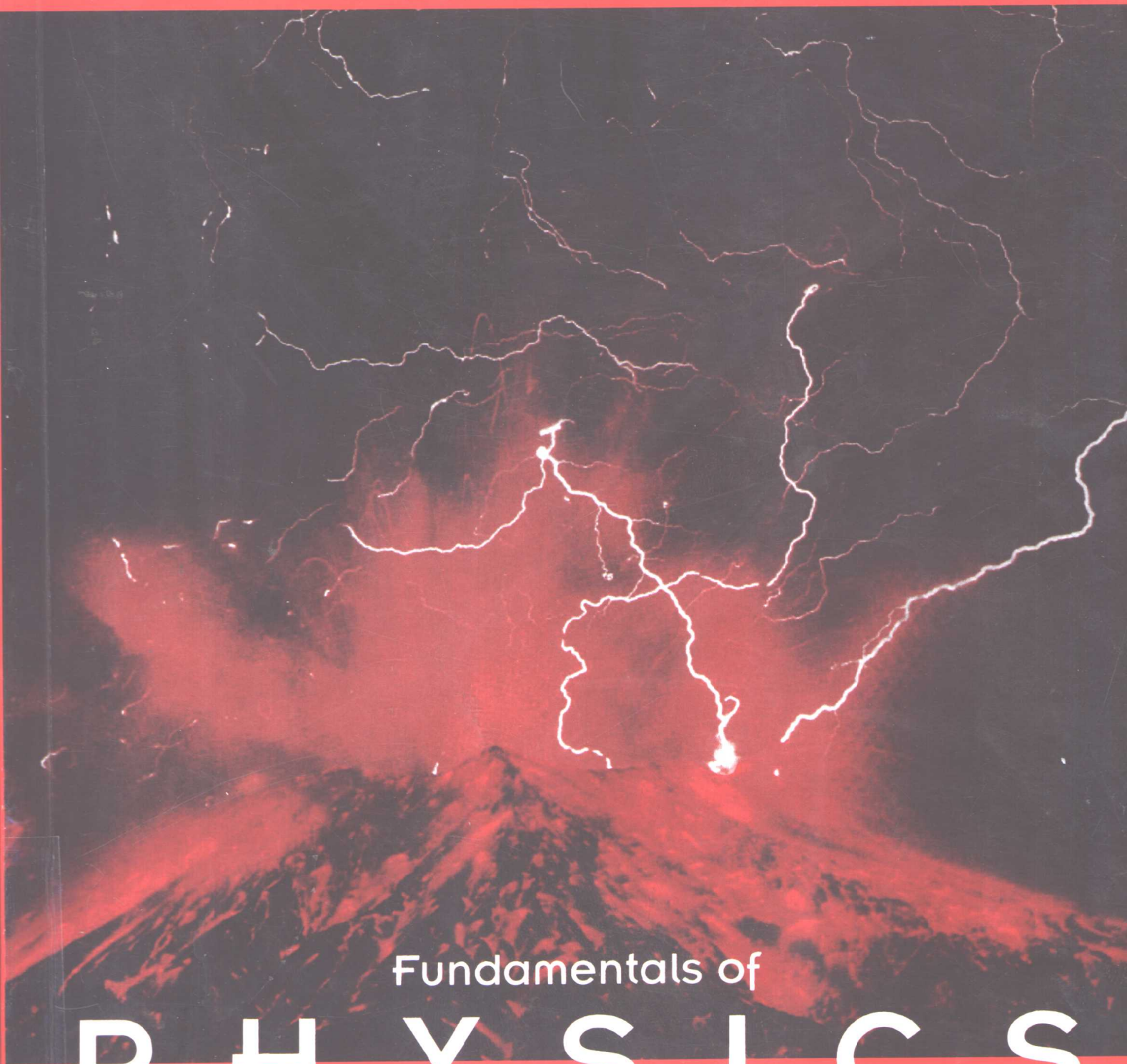

Fundamentals of

PHYSICS

Sixth Edition

SIXTH

Fundamentals of Physics

EXTENDED

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Problem Solving Tactics

PREFACE

This sixth edition of *Fundamentals of Physics* contains a redesign and major rewrites of the widely used fifth edition, while maintaining many elements of the classic text first written by David Halliday and Robert Resnick. Nearly all the changes are based on suggestions from instructors and students using the fifth edition, from reviewers of the manuscripts for the sixth edition, and from research done on the process of learning. You can send suggestions, corrections, and positive or negative comments to John Wiley & Sons (http://www.wiley.com/college/hrw) or Jearl Walker (mail address: Physics Department, Cleveland State University, Cleveland OH 44115 USA; fax number: (USA) (216) 687-2424; or email address: physics@wiley.com). We may not be able to respond to all suggestions, but we keep and study each of them.

Design Changes

➤ ***More open format.*** Previous editions have been printed in a double-column format, which many students and instructors have found cluttered and distracting. In this edition, the narrative is presented in a single-column format with a wide margin for note-taking.

➤ ***Streamlined presentation.*** It is a common complaint of all texts that they cover too much material. As a response to this criticism, the sixth edition has been shortened in two ways.

1. Material regarding special relativity and quantum physics has been moved from the early chapters to the later chapters devoted to those subjects.

2. The essential sample problems have been retained in this book, but the more specialized sample problems have been shifted to the Problem Supplement that is automatically provided with this book. (The Problem Supplement is described on the next page.)

➤ ***Vector notation.*** Vectors are now presented with an overhead arrow (such as $\vec{F}$) instead of as a bold symbol (such as **F**).

➤ ***Emphasis on metric units.*** Except in Chapter 1 (in which various systems of units are employed) and certain problems involving baseball (in which English units are traditional), metric units are used almost exclusively.

➤ ***Structured versus unstructured order of problems.*** The homework problems in this book are still ordered approximately according to their difficulty and grouped under section titles corresponding to the narrative of the chapter. However, many of the homework problems of the fifth edition have been shifted, without order or grouping, to the Problem Supplement. (The total number of problems in this book and in the Problem Supplement exceeds what was available in the fifth edition.)

➤ ***Icons for additional help.*** When worked-out solutions are provided either in print or electronically for certain of the odd-numbered homework problems, the statements for those problems include a trailing icon to alert both student and instructor as to where the solutions are located. An icon guide is provided here and at the beginning of each set of homework problems:

ssm Solution is in the Student Solutions Manual.
www Solution is available on the World Wide Web at: http://www.wiley.com/college/hrw
ilw Solution is available on the Interactive LearningWare.

These resources are described later in this preface.

Pedagogy Changes

➤ ***Reasoning versus plug-and-chug.*** The primary goal of this book is to teach students to reason through challenging situations, from basic principles to a solution. Although some plug-and-chug homework problems remain in this book, most homework problems emphasize reasoning.

➤ ***Key Ideas in the sample problems.*** The solutions to all 360 sample problems in this book and in the Problem Supplement have been rewritten to begin with one or more Key Ideas based on basic principles.

➤ ***Lengthened solutions to sample problems.*** Most of the solutions to the sample problems are now longer because they build step by step from the beginning Key Ideas to an answer, often repeating some of the important reasoning of the narrative preceding the sample problems. For example, see Sample Problem 8-3 on page 148 and Sample Problem 10-2 on pages 200–201.

➤ ***Use of vector-capable calculators.*** When vector calculations in a sample problem can be performed directly on-screen with a vector-capable calculator, the solution of the sample problem indicates that fact but still carries through the traditional component analysis. When vector calculations

cannot be performed directly on-screen, the solution explains why.

➤ ***Problems with applied physics,*** based on published research, have been added in many places, either as sample problems or homework problems. For example, see Sample Problem 11-6 on page 229, homework problem 64 on page 71, and homework problem 56 on page 214. For an example of homework problems that build with a continuing story, see problems 4, 32, and 48 (on pages 112, 114, and 115, respectively) in Chapter 6.

Content Changes

➤ ***Chapter 5 on force and motion*** contains clearer explanations of the gravitational force, weight, and normal force (pages 80–82).

➤ ***Chapter 7 on kinetic energy and work*** begins with a rough definition of energy. It then defines kinetic energy, work, and the work–kinetic energy theorem in ways that are more closely tied to Newton's second law than in the fifth edition, while keeping those definitions consistent with thermodynamics (pages 117–120).

➤ ***Chapter 8 on the conservation of energy*** avoids the much criticized definition of work done by a nonconservative force by explaining, instead, the energy transfers that occur due to a nonconservative force (page 153). (The wording still allows an instructor to superimpose a definition of work done by a nonconservative force.)

➤ ***Chapter 10 on collisions*** now presents the general situation of inelastic one-dimensional collisions (pages 198–200) before the special situation of elastic one-dimensional collisions (pages 202–204).

➤ ***Chapters 16, 17, and 18 on SHM and waves*** have been rewritten to better ease a student into these difficult subjects.

➤ ***Chapter 21 on entropy*** now presents a Carnot engine as the ideal heat engine with the greatest efficiency.

Chapter Features

➤ ***Opening puzzlers.*** A curious puzzling situation opens each chapter and is explained somewhere within the chapter, to entice a student to read the chapter.

➤ ***Checkpoints*** are stopping points that effectively ask the student, "Can you answer this question with some reasoning based on the narrative or sample problem that you just read?" If not, then the student should go back over that previous material before traveling deeper into the chapter. For example, see Checkpoint 3 on page 78 and Checkpoint 1 on page 101. **Answers to all checkpoints are in the back of the book.**

➤ ***Sample problems*** have been chosen to help the student organize the basic concepts of the narrative and to develop problem-solving skills. Each sample problem builds step by step from one or more Key Ideas to a solution.

➤ ***Problem-solving tactics*** contain helpful instructions to guide the beginning physics student as to how to solve problems and to avoid common errors.

➤ ***Review & Summary*** is a brief outline of the chapter contents that contains the essential concepts but which is not a substitute for reading the chapter.

➤ ***Questions*** are like the checkpoints and require reasoning and understanding rather than calculations. **Answers to the odd-number questions are in the back of the book.**

➤ ***Exercises & Problems*** are ordered approximately according to difficulty and grouped under section titles. **The odd-numbered ones are answered in the back of the book.** Worked-out solutions to the odd-numbered problems with trailing icons are available either in print or electronically. (See the icon guide at the beginning of the Exercises & Problems.) A problem number with a star indicates an especially challenging problem.

➤ ***Additional Problems*** appear at the end of the Exercises & Problems in certain chapters. They are not sorted according to section titles and many involve applied physics.

Problem Supplement

A problem supplement is automatically provided with this book. The *Problem Supplement #1* (green book) will be provided until May 15, 2002. Thereafter, the *Problem Supplement #2* (blue book) will be provided. The blue book will have a different set of questions and homework problems and will contain more sample problems. The features of both versions of the problem supplement are the following:

➤ ***Additional sample problems*** that were shifted from the main book, plus many new ones. All begin with the basic *Key Ideas* and then build step by step to a solution.

➤ ***Questions*** include:

1. *Checkpoint-style questions,* as in the main book.
2. *Organizing questions,* which request that equations be set up for common situations, as a warm-up for the homework problems.

3. *Discussion questions* from the fourth and earlier editions of the book (back by request).

➤ ***Exercises & Problems.*** More homework problems, including many shifted from the main book. These are *not* ordered according to difficulty, section titles, or appearance of the associated physics in the chapter. Some of the new problems involve applied physics. In some chapters the homework problems end with *Clustered Problems,* in which similar problems are grouped together. In the other chapters, the homework problems end with *Tutorial Problems,* in which solutions are worked out.

Versions of the Text

The sixth edition of *Fundamentals of Physics* is available in a number of different versions, to accommodate the individual needs of instructors and students. The Regular Edition consists of Chapters 1 through 38 (ISBN 0-471-32000-5). The Extended Edition contains seven additional chapters on quantum physics and cosmology (Chapters 1–45) (ISBN 0-471-33236-4). Both editions are available as single, hardcover books, or in the following alternative versions:

➤ ***Volume 1—Chapters 1–21 (Mechanics/Thermodynamics), hardcover, 0-471-33235-6***

➤ ***Volume 2—Chapters 22–45 (E&M and Modern Physics), hardcover, 0-471-36037-6***

➤ ***Part 1—Chapters 1–12, paperback, 0-471-33234-8***

➤ ***Part 2—Chapters 13–21, paperback, 0-471-36041-4***

➤ ***Part 3—Chapters 22–33, paperback, 0-471-36040-6***

➤ ***Part 4—Chapters 34–38, paperback, 0-471-36039-2***

➤ ***Part 5—Chapters 39–45, paperback, 0-471-36038-4***

Supplements

The sixth edition of *Fundamentals of Physics* is supplemented by a comprehensive ancillary package carefully developed to help teachers teach and students learn.

Instructor's Supplements

➤ ***Instructor's Manual*** by J. RICHARD CHRISTMAN, U.S. Coast Guard Academy. This manual contains lecture notes outlining the most important topics of each chapter, demonstration experiments, laboratory and computer projects, film and video sources, answers to all Questions, Exercises & Problems, and Checkpoints, and a correlation guide to the Questions and Exercises & Problems in the previous edition.

➤ ***Instructor's Solutions Manual*** by JAMES WHITENTON, Southern Polytechnic University. This manual provides worked-out solutions for all the exercises and problems found at the end of each chapter within the text and in the Problem Supplement #1. *This supplement is available only to instructors.*

➤ ***Test Bank*** by J. RICHARD CHRISTMAN, U.S. Coast Guard Academy. More than 2200 multiple-choice questions are included in this manual. These items are also available in the Computerized Test Bank (see below).

➤ ***Instructor's Resource CD.*** This CD contains:

- All of the Instructor's Solutions Manual in both LaTex and PDF files.
- Computerized Test Bank in both IBM and Macintosh versions, with full editing features to help instructors customize tests.
- All text illustrations suitable for both classroom presentation and printing.

➤ ***Transparencies.*** More than 200 four-color illustrations from the text are provided in a form suitable for projection in the classroom.

➤ ***On-line Course Management.***

- WebAssign, CAPA, and Wiley eGrade are on-line homework and quizzing programs that give instructors the ability to deliver and grade homework and quizzes over the Internet.
- Instructors will also have access to WebCT course materials. WebCT is a powerful Web site program that allows instructors to set up complete on-line courses with chat rooms, bulletin boards, quizzing, student tracking, etc. Please contact your local Wiley representative for more information.

Student's Supplements

➤ ***A Student Companion*** by J. RICHARD CHRISTMAN, U.S. Coast Guard Academy. This student study guide consists of a traditional print component and an accompanying Web site, which together provide a rich, interactive environment for review and study. The Student Companion Web site includes self-quizzes, simulation exercises, hints for solving end-of-chapter problems, the *Interactive LearningWare* program (see the next page), and links to other Web sites that offer physics tutorial help.

➤ ***Student Solutions Manual*** by J. RICHARD CHRISTMAN, U.S. Coast Guard Academy and EDWARD DERRINGH, Wentworth Institute. This manual provides students with complete worked-out solutions to 30 percent of the ex-

ercises and problems found at the end of each chapter within the text. These problems are indicated with an SSM icon in the text.

➤ ***Interactive LearningWare.*** This software guides students through solutions to 200 of the end-of-chapter problems. The solutions process is developed interactively, with appropriate feedback and access to error-specific help for the most common mistakes. These problems are indicated with an ILW icon in the text.

➤ ***CD-Physics, 3.0.*** This CD-ROM based version of *Fundamentals of Physics,* Sixth Edition, contains the complete, extended version of the text, *A Student's Companion,* the *Student's Solutions Manual,* the *Interactive LearningWare,* and numerous simulations all connected with extensive hyperlinking.

➤ ***Take Note!*** This bound notebook lets students take notes directly onto large, black-and-white versions of textbook illustrations. All of the illustrations from the transparency set are included. In-class time spent copying illustrations is substantially reduced by this supplement.

➤ ***Physics Web Site.*** This Web site, **http://www.wiley.com/college/hrw**, was developed specifically for *Fundamentals of Physics,* Sixth Edition, and is designed to further assist students in the study of physics and offers additional physics resources. The site also includes solutions to selected end-of-chapter problems. These problems are identified with a WWW icon in the text.

[redacted]MENTS

A textbook contains far more contributions to the elucidation of a subject than those made by the authors alone. J. Richard Christman, of the U.S. Coast Guard Academy, has once again created many fine supplements for us; his knowledge of our book and his recommendations to students and faculty are invaluable. James Tanner, of Georgia Institute of Technology, and Gary Lewis, of Kennesaw State College, have provided us with innovative software, closely tied to the text exercises and problems. James Whitenton, of Southern Polytechnic State University, and Jerry Shi, of Pasadena City College, performed the Herculean task of working out solutions for every one of the Exercises & Problems in the text. We thank John Merrill, of Brigham Young University, and Edward Derringh, of the Wentworth Institute of Technology, for their many contributions in the past. We also thank George W. Hukle of Oxnard, California, and Frank G. Jacobs of Evanston, Illinois, for their check of the answers for the problems in the book.

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We owe a particular debt of gratitude to the numerous students who used the previous editions of *Fundamentals of Physics* and took the time to fill out the response cards and return them to us. As the ultimate consumers of this text, students are extremely important to us. By sharing their opinions with us, your students help us ensure that we are providing the best possible product and the most value for their textbook dollars. We encourage the users of this book to contact us with their thoughts and concerns so that we can continue to improve this text in the years to come.

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BRIEF CONTENTS

VOLUME 1

VOLUME 2

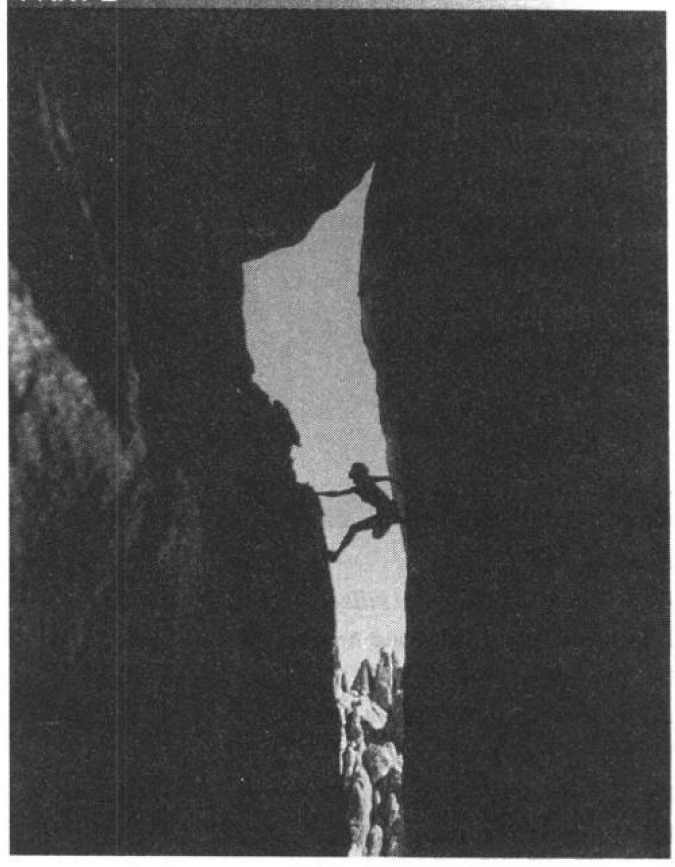
TABLES

CONTENTS

CHAPTER 11

CHAPTER 12

PART 2



CHAPTER 13

CHAPTER 14