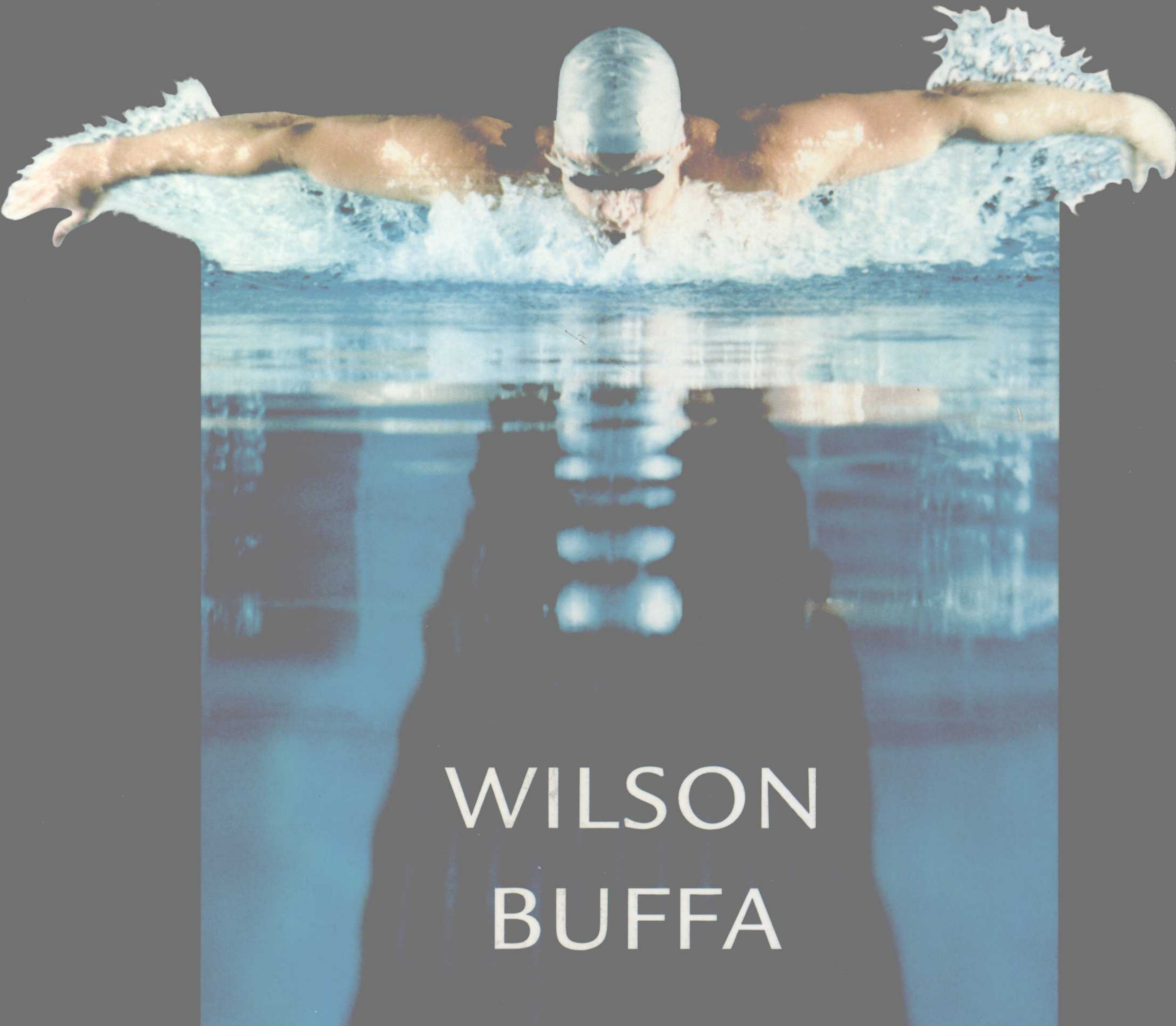
Annotated Instructor's Edition

COLLEGE PHYSICS

FIFTH EDITION



WILSON

BUFFA

Annotated Instructor's Edition

College Physics

Fifth Edition

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Greenwood, SC

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California Polytechnic State University
San Luis Obispo, CA

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Prentice Hall

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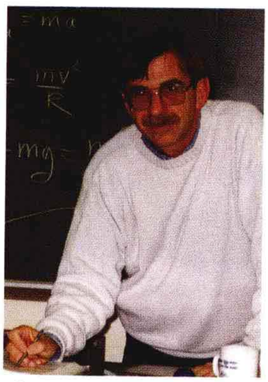
About the Authors

Jerry D. Wilson, a native of Ohio, is Emeritus Professor of Physics and former Chair of the Division of Biological and Physical Sciences at Lander University in Greenwood, South Carolina. He received his B.S. degree from Ohio University, M.S. degree from Union College, and, in 1970, a Ph.D. from Ohio University. He earned his M.S. degree while employed as a Materials Behavior Physicist by the General Electric Co.

As a doctoral graduate student, Professor Wilson held the faculty rank of Instructor and began teaching physical-science courses. During this time, he coauthored a physical-science text that is now in its 10th edition. In conjunction with his teaching career, Professor Wilson continued his writing and has authored or coauthored six titles. Having retired from full-time teaching, he continues to write, producing, among other works, *The Curiosity Corner*, a weekly column for local newspapers that can also be found on the Internet.

With several competitive books available, one may wonder why I chose to cowrite another algebra-based physics text. Having taught introductory physics many times, I was well aware of the needs of students and the difficulties they have in mastering the subject. I decided to write a text that presents the basic physics principles in a clear and concise manner, with illustrative examples that help resolve the major difficulty in learning physics: problem solving. Also, I wanted to write a text that is relevant to real-life situations, so as to show students how physics applies in their everyday world, how things work, and why things happen. Once the basics are learned, an understanding of such applications follows naturally.

—Jerry Wilson



Anthony J. Buffa received his B.S. degree in physics from Rensselaer Polytechnic Institute and both his M.S. and Ph.D. degrees in physics from the University of Illinois, Urbana–Champaign. In 1970, Professor Buffa joined the faculty at California Polytechnic State University, San Luis Obispo, where he is currently Professor of Physics, and has been a research associate with the Radioanalytical Facility of the department of physics since 1980.

Professor Buffa's main interest continues to be teaching. He has taught courses at Cal Poly ranging from introductory physical science to quantum mechanics, has developed and revised many laboratory experiments, and has taught elementary physics to local teachers in an NSF-sponsored workshop. Combining physics with his interests in art and architecture, Dr. Buffa develops his own artwork and sketches, which he uses to increase his effectiveness in teaching physics.

I try to teach my students the crucial role physics plays in understanding all aspects of the world around them—whether it be technology, biology, astronomy, or any other field. In that regard, I emphasize conceptual understanding before number crunching. To this end, I rely heavily on visual methods. I hope the artwork and other pedagogical features in this book assist you in achieving your own teaching goals for your students.

—Tony Buffa

Preface

We believe that there are two basic goals in any introductory physics course: (1) to impart an understanding of the basic concepts of physics and (2) to enable students to use these concepts to solve a variety of problems.

These goals are linked. We want students to apply concepts to the problems that they are trying to solve. However, they often begin the problem-solving process by searching for an equation. There is the temptation to try and plug numbers into equations before visualizing the situation or considering the physical concepts that could be used to solve the problem.

Research in physics education has shown that a surprising number of students who learn to solve typical problems well enough to pass examinations do so without ever arriving at a real understanding of the most elementary physical concepts. Simply put, they can solve quantitative problems and get the right answer, but they do not know why it is right. In addition, students often do not check their numerical answer to see if it matches their understanding of the relevant physical concept.

Our Goals—Features of the Fifth Edition

Our goals for the Fifth Edition of this text are simple, yet challenging. With the goals of the course in mind, we identified areas in need of improvement and made efforts to further enhance the strengths of the book.

First, we asked a trusted colleague to contribute to our efforts. Bo Lou, of Ferris State University, has been an important part of *College Physics* since the Third Edition. He has authored the *Instructor's Solutions Manual* and the *Student Study Guide* and has played an important role as a member of AZTEC (Absolutely Zero Tolerance for Errors Club). In this edition, his expertise in optics has been used to update the chapters dealing with that topic (Chapters 22–25). Also, Professor Lou was responsible for updating the end-of-chapter exercises. His Ph.D., in condensed-matter physics, is from Emory University.

We feel, and many users have agreed, that the strengths of this textbook are as follows:

Conceptual Basis. We believe that giving students a secure grasp of physical principles will almost invariably enhance their problem-solving abilities. Central to this belief is an approach to the development of problem-solving skills that stresses an understanding of basic concepts, rather than the mechanical and rote use of equations, as the essential foundation. Throughout the writing of *College Physics*, we have organized discussions and incorporated pedagogical tools to ensure that conceptual insight drives the development of practical skills.

Concise Coverage. To maintain a sharp focus on essential concepts, a textbook should emphasize the basics and minimize superfluous material. In this text, topics of marginal interest have been avoided, as have those that present formal or mathematical difficulties for students. Similarly, we have not wasted space on deriving relationships when they shed no additional light on the principle involved. It is usually more important for students in a course such as this book is geared toward to understand what a relationship means and how it can be used, rather than the mathematical or analytical techniques employed to derive it.

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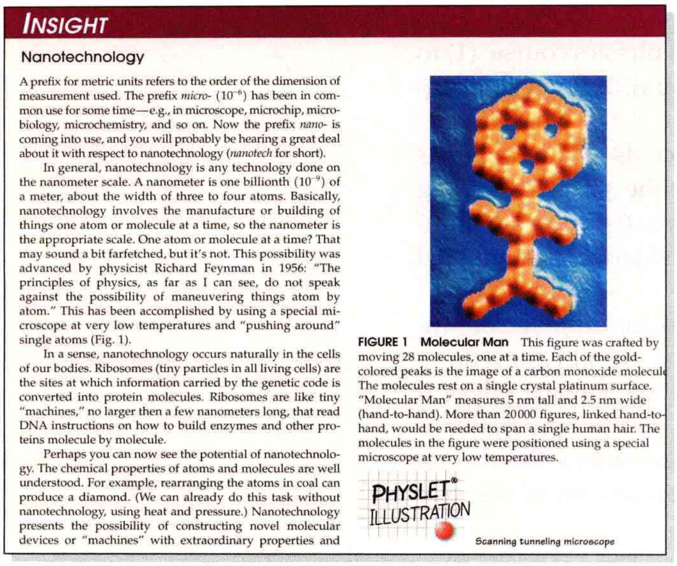
Applications. *College Physics* is known for the strong mix of applications related to medicine, science, technology, architecture, and everyday life in its text narrative and Insight boxes. While the Fifth Edition continues to have a wider range of applications than do most texts, we have also increased the number of biological applications, in recognition of the high percentage of premed and allied health majors who take the course for which it is used. Some examples of topics discussed in biology-oriented Insights are nanotechnology, weight-lessness and its effects on the human body, the physics of ear popping, desirable and undesirable resonance, body-fat analysis, cornea surgery, and bioengineering. A complete list of applications discussed, with page references, is found on page xiii.



INSIGHT

Nanotechnology

A prefix for metric units refers to the order of the dimension of measurement used. The prefix *micro-* (10^{-6}) has been in common use for some time—e.g., in microscope, microchip, microbiology, microchemistry, and so on. Now the prefix *nano-* is coming into use, and you will probably be hearing a great deal about it with respect to nanotechnology (*nanotech* for short).

In general, nanotechnology is any technology done on the nanometer scale. A nanometer is one billionth (10^{-9}) of a meter, about the width of three to four atoms. Basically, nanotechnology involves the manufacture or building of things one atom or molecule at a time, so the nanometer is the appropriate scale. One atom or molecule at a time? That may sound a bit farfetched, but it's not. This possibility was advanced by physicist Richard Feynman in 1956: "The principles of physics, as far as I can see, do not speak against the possibility of maneuvering things atom by atom." This has been accomplished by using a special microscope at very low temperatures and "pushing around" single atoms (Fig. 1).

In a sense, nanotechnology occurs naturally in the cells of our bodies. Ribosomes (tiny particles in all living cells) are the sites at which information carried by the genetic code is converted into protein molecules. Ribosomes are like tiny "machines," no larger then a few nanometers long, that read DNA instructions on how to build enzymes and other proteins molecule by molecule.

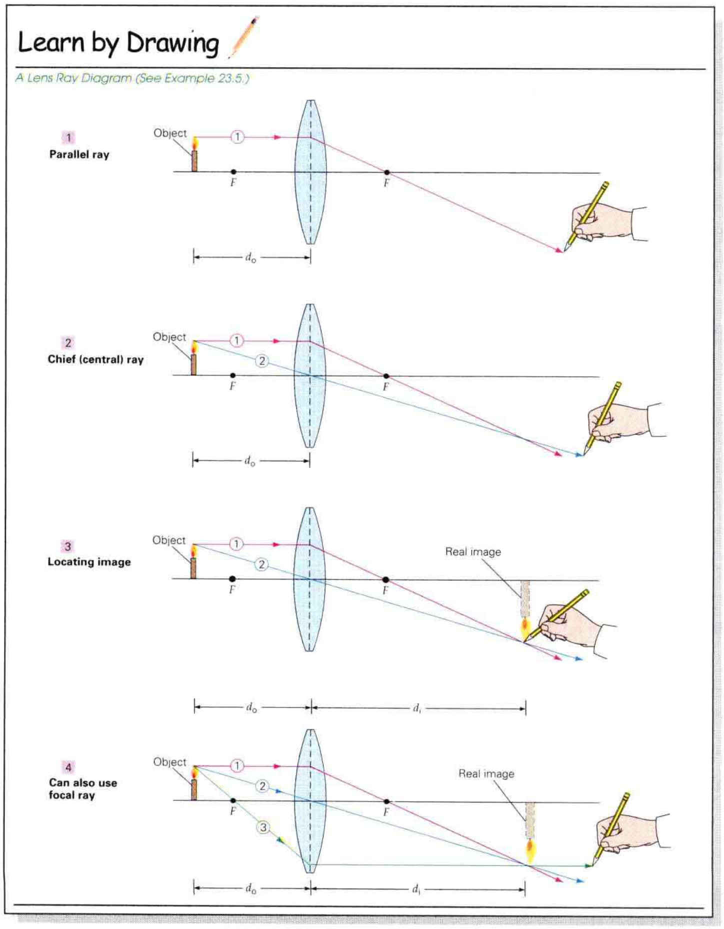
Perhaps you can now see the potential of nanotechnology. The chemical properties of atoms and molecules are well understood. For example, rearranging the atoms in coal can produce a diamond. (We can already do this task without nanotechnology, using heat and pressure.) Nanotechnology presents the possibility of constructing novel molecular devices or "machines" with extraordinary properties and

FIGURE 1 Molecular Man This figure was crafted by moving 28 molecules, one at a time. Each of the gold-colored peaks is the image of a carbon monoxide molecule. The molecules rest on a single crystal platinum surface. "Molecular Man" measures 5 nm tall and 2.5 nm wide (hand-to-hand). More than 20 000 figures, linked hand-to-hand, would be needed to span a single human hair. The molecules in the figure were positioned using a special microscope at very low temperatures.

PHYSLET® ILLUSTRATION

Scanning tunneling microscope

The following pedagogical features have been enhanced in the Fifth Edition:

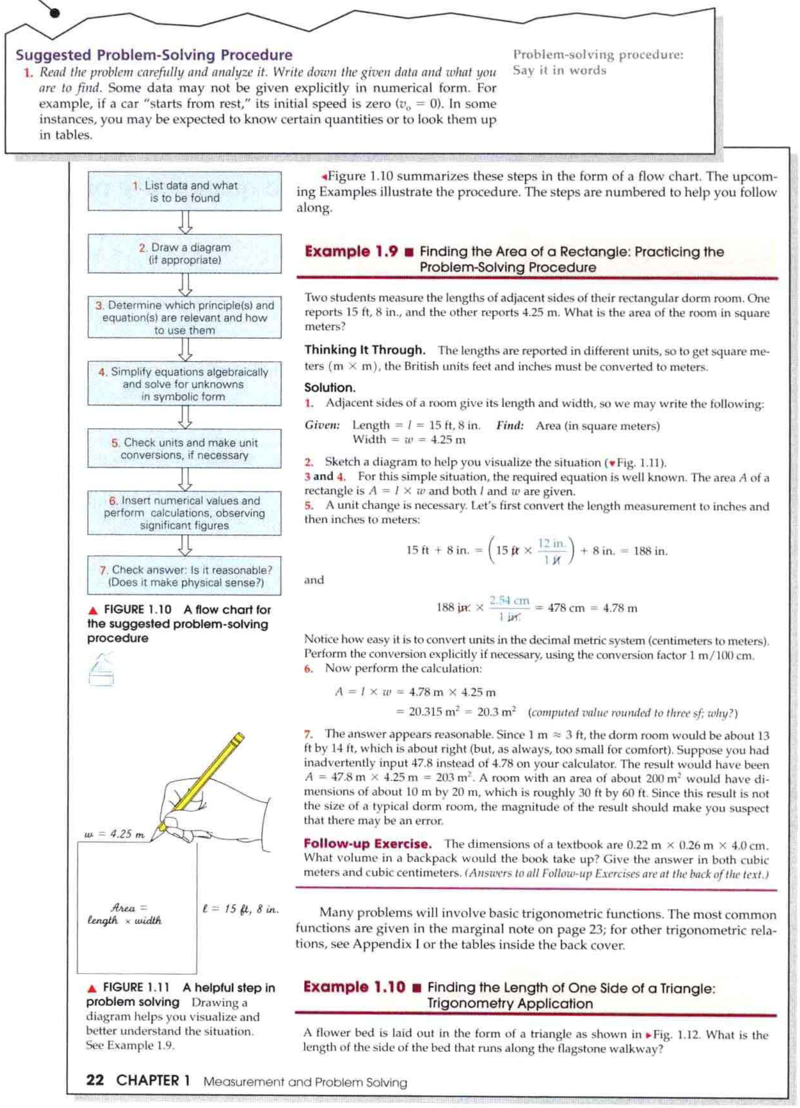


Learn by Drawing Boxes. Visualization is one of the most important problem-solving tools in physics. In many cases, if students can make a sketch of a problem, they can solve it. "Learn by Drawing" features offer students specific help on making certain types of sketches and graphs that will provide key insights into a variety of physical situations.

Integrated Learning Objectives. Specific learning objectives, located at the beginning of each chapter section, help students structure their reading and facilitate review of the material.

Suggested Problem-Solving Procedure. An extensive section (Section 1.7) provides a framework for thinking about problem solving. This section includes

- An overview of problem-solving strategies;
- A seven-step procedure that is general enough to apply to most problems in physics, but is easily used in specific situations;
- Three Examples that illustrate the detailed problem-solving process, showing how the general procedure is applied in practice.


Suggested Problem-Solving Procedure

1. *Read the problem carefully and analyze it. Write down the given data and what you are to find.* Some data may not be given explicitly in numerical form. For example, if a car "starts from rest," its initial speed is zero ($v_o = 0$). In some instances, you may be expected to know certain quantities or to look them up in tables.

Problem-solving procedure: Say it in words

◂Figure 1.10 summarizes these steps in the form of a flow chart. The upcoming Examples illustrate the procedure. The steps are numbered to help you follow along.

▲ **FIGURE 1.10 A flow chart for the suggested problem-solving procedure**

Example 1.9 ■ Finding the Area of a Rectangle: Practicing the Problem-Solving Procedure

Two students measure the lengths of adjacent sides of their rectangular dorm room. One reports 15 ft, 8 in., and the other reports 4.25 m. What is the area of the room in square meters?

Thinking It Through. The lengths are reported in different units, so to get square meters (m × m), the British units feet and inches must be converted to meters.

Solution.

1. Adjacent sides of a room give its length and width, so we may write the following:

Given: Length = l = 15 ft, 8 in. *Find:* Area (in square meters)
Width = w = 4.25 m

2. Sketch a diagram to help you visualize the situation (▾Fig. 1.11).

3 and 4. For this simple situation, the required equation is well known. The area A of a rectangle is $A = l \times w$ and both l and w are given.

5. A unit change is necessary. Let's first convert the length measurement to inches and then inches to meters:

$$15 \text{ ft} + 8 \text{ in.} = \left(15 \text{ ft} \times \frac{12 \text{ in.}}{1 \text{ ft}}\right) + 8 \text{ in.} = 188 \text{ in.}$$

and

$$188 \text{ in.} \times \frac{2.54 \text{ cm}}{1 \text{ in.}} = 478 \text{ cm} = 4.78 \text{ m}$$

Notice how easy it is to convert units in the decimal metric system (centimeters to meters). Perform the conversion explicitly if necessary, using the conversion factor 1 m/100 cm.

6. Now perform the calculation:

$$A = l \times w = 4.78 \text{ m} \times 4.25 \text{ m}$$
$$= 20.315 \text{ m}^2 = 20.3 \text{ m}^2 \quad \textit{(computed value rounded to three sf; why?)}$$

7. The answer appears reasonable. Since 1 m ≈ 3 ft, the dorm room would be about 13 ft by 14 ft, which is about right (but, as always, too small for comfort). Suppose you had inadvertently input 47.8 instead of 4.78 on your calculator. The result would have been $A = 47.8 \text{ m} \times 4.25 \text{ m} = 203 \text{ m}^2$. A room with an area of about 200 m^2 would have dimensions of about 10 m by 20 m, which is roughly 30 ft by 60 ft. Since this result is not the size of a typical dorm room, the magnitude of the result should make you suspect that there may be an error.

Follow-up Exercise. The dimensions of a textbook are 0.22 m × 0.26 m × 4.0 cm. What volume in a backpack would the book take up? Give the answer in both cubic meters and cubic centimeters. *(Answers to all Follow-up Exercises are at the back of the text.)*

▲ **FIGURE 1.11 A helpful step in problem solving** Drawing a diagram helps you visualize and better understand the situation. See Example 1.9.

Many problems will involve basic trigonometric functions. The most common functions are given in the marginal note on page 23; for other trigonometric relations, see Appendix I or the tables inside the back cover.

Example 1.10 ■ Finding the Length of One Side of a Triangle: Trigonometry Application

A flower bed is laid out in the form of a triangle as shown in ▸Fig. 1.12. What is the length of the side of the bed that runs along the flagstone walkway?

22 CHAPTER 1 Measurement and Problem Solving

Problem-Solving Strategies and Hints.

The initial treatment of problem solving is followed up throughout *College Physics* with an abundance of suggestions, tips, cautions, shortcuts, and useful techniques for solving specific kinds of problems. These strategies and hints help students apply general principles to specific contexts, as well as avoid common pitfalls and misunderstandings.

Conceptual Examples. *College Physics* was among the first physics texts to include examples that are conceptual in nature, in addition to quantitative ones. Our Conceptual Examples ask students to think about a physical situation and choose the correct prediction out of a set of possible outcomes, on the basis of an understanding of relevant principles. The discussion that follows ("Reasoning and Answer") explains clearly how the correct answer can be identified, as well as why the other answers are wrong.

Worked Examples. We have tried to make the solutions to in-text Examples as clear and detailed as possible. The aim is not merely to show students which equations to use, but to explain the strategy being employed and the role of each step in the overall plan. Students are encouraged to learn the "why" of each step along with the "how." This technique will make it easier for students to apply the demonstrated techniques to other problems that are not identical in structure. Each worked Example also includes the following:

- ***Thinking It Through Step.*** This section, which follows the statement of the problem and precedes the solution, focuses students on the critical thinking and analysis they should undertake before beginning to use equations.
- ***Follow-up Exercise.*** The Follow-up Exercise at the end of each Conceptual Example and each regular worked Example further reinforces the importance of conceptual understanding and offers additional practice. (Answers to Follow-up Exercises are given at the back of the text.)

Integration of Conceptual and Quantitative Exercises. To help break down the artificial barrier between conceptual questions and quantitative problems, we do not separate these categories in the end-of-chapter exercises. Instead, each section begins with a series of multiple-choice and short-answer questions that provide review of the chapter's content, test students' conceptual understanding, and ask students to reason from principles. The aim is to show students that the same kind of conceptual insight is required regardless of whether the desired answer involves words, equations, or numbers. The conceptual questions are marked by a bold CQ in the text for easy reference when assigning questions. *College Physics* offers short answers to all odd-numbered conceptual questions (as well as to all odd-numbered quantitative problems) at the back of the text, so that students can check their understanding of those problems.

Paired Exercises. Most numbered sections include at least one set of paired Exercises that deal with similar situations. The first problem in a pair is solved in the *Student Study Guide and Solutions Manual;* the second problem, which explores a similar situation to that presented in the first prob-lem, has only an answer at the back of the book, thereby encouraging students to work out the problem on their own.

Additional Exercises. Each chapter includes a supplemental section of Additional Exercises drawn from all sections of the chapter, to ensure that students can synthesize concepts.

New features to the Fifth Edition include the following:

Physlet® Illustrations. Physlet® Illustrations are short Java applets that clearly illustrate, through animation, a concept from the text. Available on the Wilson/Buffa Companion Web site, Physlet® Illustrations are followed by a series of questions that ask students to think critically about the concept at hand. Physlet® Illustrations are denoted by an icon in the margin of the text.

($\mathbf{F}_{\text{net}} = m\mathbf{a}$) and inserting the expression for centripetal acceleration from Eq. 7.9, we can write

$$F_c = ma_c = \frac{mv^2}{r} \quad \textit{magnitude of centripetal force} \qquad (7.11)$$

PHYSLET® ILLUSTRATION

Centripetal Force

The centripetal force, like the centripetal acceleration, is directed radially toward the center of the circular path.

Keep in mind that, in general, a net force applied at an angle to the direction of motion of an object produces changes in the magnitude *and* direction of the velocity. However, when a net force of constant magnitude is continuously applied at an angle of 90° to the direction of motion (as is centripetal force), only the direction of the velocity changes. Also notice that because the centripetal force is always perpendicular to the direction of motion, this force does no work. (Why?) Therefore, by the work–energy theorem, a centripetal force does not change the kinetic energy or speed of the object.

Note that the centripetal force in the form $F = mv^2/r$ is not really a new individual force, but rather the cause of the centripetal acceleration supplied by a real force or forces. In Example 7.5, the force supplying the centripetal acceleration was gravity. In Conceptual Example 7.7, it was the tension in the string. Another force that often supplies centripetal acceleration is friction. Suppose that an automobile moves into a level, circular curve. To negotiate the curve, the car must have a centripetal acceleration, which is supplied by the force of friction between the tires and the road.

However, this (static; why?) friction has a maximum limiting value. If the speed of the car is high enough, the friction will not be sufficient to supply the necessary centripetal acceleration, and the car will skid outward from the center of the curve. If the car moves onto a wet or icy spot, the friction between the tires and the road may be reduced, allowing the car to skid at an even lower speed. (Banking a curve also helps vehicles negotiate the curve. See Exercises 45 and 59.)

230 CHAPTER 7 Circular Motion and Gravitation

Integrated Examples. In order to further emphasize the connection between conceptual understanding and quantitative problem-solving, we have developed Integrated Examples for each chapter. These Examples work through a physical situation both qualitatively and quantitatively. Integrated Examples demonstrate how conceptual understanding and numerical calculations go hand in hand in understanding and solving problems.

Integrated Example 11.3 ■ Cooking Class 101: Studying Specific Heats While Boiling Water

To prepare pasta, you bring a pot of water from room temperature (20°C) to its boiling point (100°C). The pot has a mass of 0.900 kg, is made of steel, and holds 3.00 L of water. (a) Which of the following is true? (1) The pot requires more heat, (2) the water requires more heat, or (3) they require the same amount of heat. (b) Determine the required heat for both the water and the pot, and the ratio Q_w/Q_{pot}.

(a) Conceptual Reasoning. The temperature increase is the same for the water and the pot. Thus, the only factors that determine the difference in required heat are mass and specific heat. Since a liter of water has a mass of 1.0 kg, we have 3.0 kg of water to heat. This mass is more than three times the mass of the pot. From Table 11.1, the specific heat of water is about nine times larger than that of steel. Thus, both factors indicate that the water will require significantly more heat than the pot, so the answer is (2).

(b) Thinking It Through. The heats can be found using Eq. 11.1, after looking up the specific heats and converting the volume of water to mass. The temperature change is easily determined from the initial and final values.

We list the data given and find the water's mass from its volume and density:

Given: $m_{pot} = 0.900$ kg
$m_w = 3.00$ kg
$c_{pot} = 460$ J/kg·C° (From Table 11.1)
$c_w = 4186$ J/kg·C° (From Table 11.1)

Find: The heat for the water and the pot and the heat ratio Q_w/Q_{pot}

In general, the amount of heat required is given by $Q = mc\Delta T$. The temperature increase for both objects is 80 C°. Thus, the heat required for the water is

$$\begin{aligned} Q_w &= m_w c_w \Delta T_w \\ &= (3.00\text{ kg})(4186\text{ J/kg}\cdot\text{C}^\circ)(80\text{ C}^\circ) = 1.00 \times 10^6\text{ J} \end{aligned}$$

and the heat required for the pot is

$$\begin{aligned} Q_{pot} &= m_{pot} c_{pot} \Delta T_{pot} \\ &= (0.900\text{ kg})(460\text{ J/kg}\cdot\text{C}^\circ)(80\text{ C}^\circ) = 3.31 \times 10^4\text{ J} \end{aligned}$$

The water requires over 30 times the heat, since

$$\frac{Q_w}{Q_{pot}} = \frac{1.00 \times 10^6\text{ J}}{3.31 \times 10^4\text{ J}} = 30.2$$

Follow-up Exercise. (a) In this Example, if the pot were made of the same mass of aluminum, would you expect the ratio of heat (water to pot) to be smaller or larger than the answer for the steel pot? Explain. (b) Verify your choice by calculating this ratio for the case of the aluminum pot.

Integrated Exercises. Like the Integrated Examples in the chapter, Integrated Exercises ask students to solve a problem quantitatively as well as answer a conceptual question dealing with the

Exercise. By answering both parts, students can see if their numerical answer matches their conceptual understanding.

Figure Reference Icon. In the Fifth Edition, we have placed an arrow next to each in-text figure reference as well as next to each figure caption. These "placeholders" point the student in the direction of the appropriate figure and are easily located when the student returns to the sentence.

Chapter Review. The Important Concepts and Equations section is integrated into the new Chapter Review section of each chapter. Key concepts are in bold and defined in words as well as symbolically. This new format provides a quick study reference for students.

We have continued to ensure accuracy through the Absolutely Zero Tolerance for Errors Club (The AZTECs). This team approach to accuracy checking worked quite well in the third and fourth editions, so we did it again. Bo Lou of Ferris State University, the author of our *Instructor's Solutions Manual*, headed the AZTEC team and was supported by the text's authors and two other accuracy checkers, Bill McCorkle of West Liberty State University and Dave Curott of the University of North Alabama. Each member of the team individually and independently worked all end-of-chapter Exercises. The results were then collected, and any discrepancies were resolved by a team discussion. All data in the chapters, as well as the answers at the back of the book, were checked and rechecked in first- and second-page proofs. In addition, five other physics teachers—Xiaochun He of Georgia State University, Jerry Shi of Pasadena City College, John Walkup of California Polytechnic State University at San Luis Obispo, William Dabby of Edison Community College, and Donald Elliott of Carroll College—read pages in detail, checking for errors in the chapter narrative, worked Examples, and text art. Although it is almost certainly not humanly possible to produce a physics text with absolutely no errors, that was our goal; we worked very hard to make the book as error free as possible.

The Fifth Edition is supplemented by a state-of-the-art Media and Print Ancillary package developed to address the needs of both students and instructors.

Companion Web Site. Our Web site (http://www.prenhall.com/wilson), which hosts contributions from leaders in physics education research, provides students with a variety of interactive explorations of each chapter's topics, easily accommodating differences in learning styles. Student tools provided on the Web site include Physlet® Illustrations by Steve Mellema and Chuck Niederriter (Gustavus Adolphus College); Warm-Ups, Puzzles, and "What Is Physics Good For?" applications by Gregor Novak and Andy Gavrin (Indiana University–Purdue University, Indianapolis); award-winning Java-based Physlet® problems by Wolfgang Christian (Davidson College); algorithmically generated numerical Practice Problems, multiple-choice Practice Questions, and on-line destinations by Carl Adler (East Carolina University); Ranking Task Exercises edited by Tom O'Kuma (Lee College), David Maloney (Indiana University–Purdue University, Fort Wayne), and Curtis Hieggelke (Joliet Junior College); Chapter Objectives and Solutions to Select Exercises by Bo Lou (Ferris State University); and MCAT Questions by Glen Terrell (University of Texas at Arlington) and from ARCO's MCAT Supercourse. Using the Preferences module on the opening page of the site or the tool in the "Results reporter" part of each module, students can, at a professor's request, have the results of their work on the Companion Web site e-mailed to the professor or teaching assistant. Instructor tools include on-line grading capabilities and a Syllabus Manager. See pp. **xxx–xxxi** for further information about the modules in this site.

For the Instructor

Annotated Instructor's Edition (0-13-047193-3). The margins of the *Annotated Instructor's Edition* (*AIE*) contain an abundance of suggestions for classroom demonstrations and activities, along with teaching tips (points to emphasize, discussion suggestions, and common misunderstandings to avoid). In addition, the *AIE* contains

- Icons that identify each illustration reproduced as a transparency in the *Transparency Pack* and
- Answers to end-of-chapter Exercises (following each Exercise).

Instructor's Resource Manual (0-13-047180-1). Written by Kathy Whatley and Judy Beck (both of University of North Carolina–Asheville), the IRM, new to this edition, provides teaching suggestions, lecture outlines, notes, demonstrations, sample syllabi, and additional references and resources.

Instructor's Solutions Manual (0-13-047194-1). Prepared by Bo Lou of Ferris State University, the *Instructor's Solutions Manual* supplies answers with complete, worked-out solutions to all end-of-chapter exercises. Each solution has been checked for accuracy by a minimum of five instructors. This manual is also available electronically on both Windows (***0-13-047203-4***) and Macintosh (***0-13-047202-6***) platforms.

Test Item File (0-13-047196-8). Fully revised by Dave Curott of the University of North Alabama, the *Test Item File* now offers more than 2600 Multiple-Choice, Essay, True/False, and Fill-in-the-Blank questions. The questions are organized and referenced by chapter section and by question type.

Test Generator EQ (0-13-047778-8). New to the Fifth Edition, TestGenEQ is an easy-to-use, fully networkable software program for creating tests ranging from short quizzes to long exams. Questions from the *Test Item File,* including algorithmic versions, are supplied, and professors can use the Question Editor to modify existing questions or create new questions.

Transparency Pack (0-13-047199-2). The *Transparency Pack* contains more than 300 full-color acetates of text illustrations useful for class lectures. It is available upon adoption of the text.

Media Portfolio CD-ROM (0-13-047190-9). Prepared by Sue Willis (Northern Illinois University), this CD-ROM, new to the Fifth Edition, contains all the art from the text in JPEG format, for easy incorporation into presentation software. It is also available as a password-protected module on the Companion Web site.

"Physics You Can See" Video Demonstrations (0-205-12393-7). Each segment, 2–5 minutes long, demonstrates a classical physics experiment. Eleven segments are included, such as "Coin & Feather" (acceleration due to gravity), "Monkey & Gun" (rate of vertical free fall), "Swivel Hips" (force pairs), and "Collapse a Can" (atmospheric pressure).

Peer Instruction (0-13-656441-6). Authored by Eric Mazur (Harvard University), this manual explains peer instruction, an interactive teaching style that actively involves students in the learning process by focusing their attention on underlying concepts through interactive "ConcepTests," reading quizzes, and conceptual exam questions. Results are assessed though scores on the Force Concept Inventory and final exams, showing that students better understand concepts and perform more highly on conventional problems in this environment. Peer instruction can be easily adapted to fit individual lecture styles and used in a variety of settings.

Just-in-Time Teaching: Blending Active Learning with Web Technology (0-13-085034-9). Just-in-Time Teaching (JiTT) is an exciting teaching and learning methodology designed to engage students. Using feedback from preclass Web assignments, instructors can adjust classroom lessons so that students receive rapid response to the specific questions and problems they are having—instead of more generic lectures that may or may not address topics with which students actually need help. Many teachers have found that this process makes students become active and interested learners. In this resource book for educators, authors Gregor Novak (Indiana University–Purdue University, Indianapolis), Evelyn Patterson (United States Air Force Academy), Andrew Gavrin (Indiana University–Purdue University, Indianapolis), and Wolfgang Christian (Davidson College) more fully explain what Just-in-Time Teaching is, its underlying goals and philosophies, and how to implement it. They also provide an extensive section of tested resource materials that can be used in introductory physics courses with the JiTT approach.

Ranking Task Exercises in Physics (0-13-022355-7). This book, by Thomas L. O'Kuma (Lee College), David P. Maloney (Indiana University–Purdue University, Fort Wayne), and Curtis J. Hieggelke (Joliet Junior College), describes ranking tasks, which are an innovative type of conceptual exercise that asks students to make comparative judgments about a set of variations on a particular physical situation. This text is a unique resource for physics instructors who are looking for tools to incorporate more conceptual analysis in their courses. This supplement contains approximately 200 Ranking Task Exercises that cover all classical physics topics (with the exception of optics).

Physlets®: Teaching Physics with Interactive Curricular Material (0-13-029341-5). Authored by Wolfgang Christian and Mario Belloni (both of Davidson College), this text is a teacher's resource book with an accompanying CD for instructors who are interested in incorporating Physlets® into their physics courses. The book and CD discuss the pedagogy behind the use of Physlets® and provide instructors with information on how to author their own interactive curricular material, using Physlets®.

For the Student

Student Study Guide and Solutions Manual (0-13-047195-X). Updated by Bo Lou of Ferris State University, the *Student Study Guide and Solutions Manual* presents chapter-by chapter reviews, chapter summaries, additional worked examples, and solutions to paired and selected exercises.

Student Pocket Guide (0-13-047192-5). Written by Biman Das (State University of New York–Potsdam), this easy-to-carry 5" × 7" paperback contains a summary of the entire text, including all key concepts and equations, as well as tips and hints. Perfect for carrying to lectures and taking notes in.

MCAT Physics Study Guide (0-13-627951-1). This study resource, by Joseph Boone of California Polytechnic State University–San Luis Obispo, references all of the physics topics on the MCAT to the appropriate sections in the text.

此为试读，需要完整PDF请访问：www.ertongbook.com

Since most MCAT questions require more thought and reasoning than simply plugging numbers into an equation, this study guide is designed to refresh students' memory about the topics they've covered in class. Additional review, practice problems, and review questions are included.

Tutorials in Introductory Physics (0-13-097069-7). Authored by Lillian C. McDermott, Peter S. Schaffer, and the Physics Education Group at the University of Washington, this landmark book presents a series of physics tutorials designed by a leading physics education research group. Emphasizing the development of concepts and scientific reasoning skills, the tutorials focus on the specific conceptual and reasoning difficulties that students tend to encounter. The tutorials cover a range of topics in Mechanics, E & M, and Waves and Optics.

Interactive Physics Player Workbook (0-13-067108-8). Written by Cindy Schwarz of Vassar College, this highly interactive workbook and software package contains simulation projects of varying difficulty. Each includes a physics review, simulation details, hints, an explanation of results, math help, and a self-test.

Acknowledgments

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Indeed, all the members of AZTEC—Bo Lou, Dave Curott, and Bill McCorkle (West Liberty State University)—as well as the reviewers of first-and second-page proofs—William Dabby (Edison Community College), Donald Elliott (Carroll College), Xiaochun He (Georgia State University), Jerry Shi (Pasadena City College), John Walkup (California Polytechnic State University at San Luis Obispo)—deserve more than a special thanks for their tireless, timely, and extremely thorough review of all materials in the book for scientific accuracy.

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Finally, both of us would like to urge anyone using the book—student or instructor—to pass on to us any suggestions that you have for its improvement. We look forward to hearing from you.

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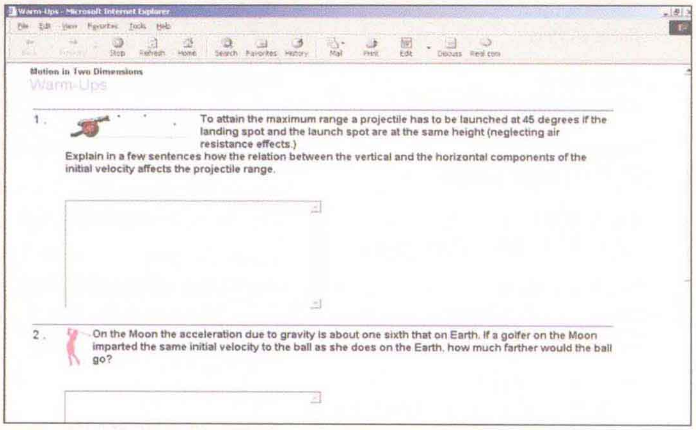
Multimedia Explorations of Physics

Companion Website www.prenhall.com/wilson

This text-specific Website for introductory physics provides students and instructors with a wealth of innovative on-line materials for use with *College Physics, Fifth Edition*.



Warm-Ups & Puzzles

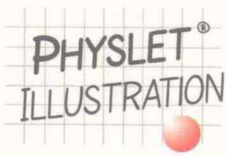
by Gregor Novak and Andrew Gavrin (Indiana University–Purdue University, Indianapolis)

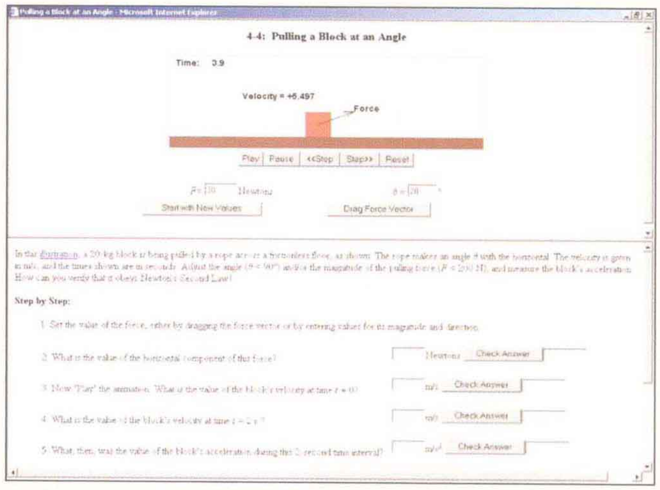
Warm-Up and Puzzle questions are real-world short-answer questions based on important concepts in the text chapters. Both types of questions get students' attention, often refer to current events, and are good discussion starters. The **Warm-Ups** are designed to help introduce a topic, whereas the **Puzzles** are more complex and often require the integration of more than one concept. Thus, professors can assign Warm-Up questions after students have read a chapter but before the class lecture on that topic, and Puzzle questions as follow-up assignments submitted after class.

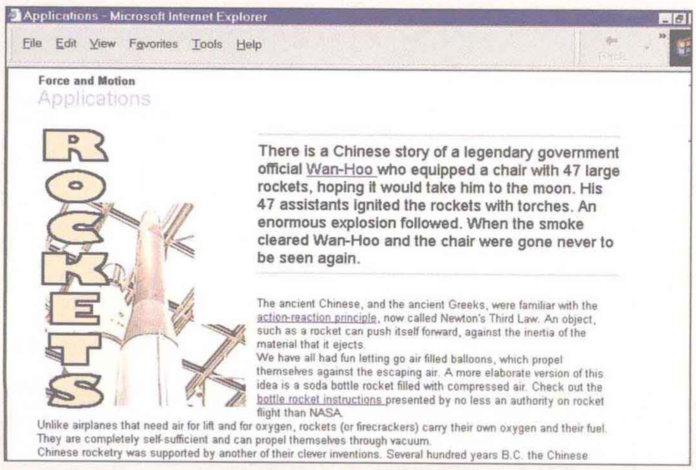
Physlet® Illustrations

by Steve Mellema and Chuck Niederritter (Gustavus Adolphus College)

New to the fifth edition, **Physlet® Illustrations** are short interactive Java applets that clearly illustrate, through animation, a concept from the text. Available on the Wilson/Buffa Companion Website, Physlet® Illustrations are often followed by a series of questions that ask students to think critically about the concept at hand. Physlet® Illustrations are denoted by an icon in the margin of the text:







Applications

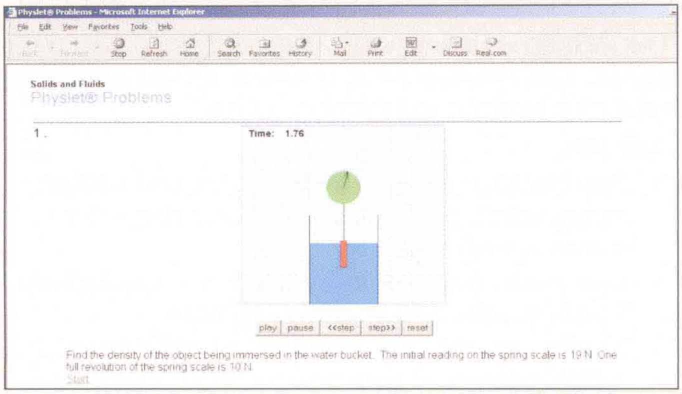
by Gregor Novak and Andrew Gavrin (Indiana University–Purdue University, Indianapolis)

The **Applications** modules answer the question "What is physics good for?" by connecting physics concepts to real-world phenomena and new developments in science and technology. These illustrated essays include embedded Web links to related sites, one for each chapter. Each essay is followed by short-answer/essay questions, which professors can assign for extra credit.

Physlet® Problems

by Wolfgang Christian (Davidson College)

Physlet® Problems are multimedia-focused problems based on Wolfgang Christian's award-winning Java applets for physics, called Physlets®. With these problems, students use multimedia elements to help solve a problem by observing, applying appropriate physics concepts, and making measurements of parameters they deem important. No numbers are given, so students are required to consider a problem qualitatively instead of plugging numbers into formulas.



Practice Questions

by Carl Adler (East Carolina University)

Two modules of 10 to15 multiple-choice **Practice Questions** are available for review with each chapter.

MCAT Study Guide

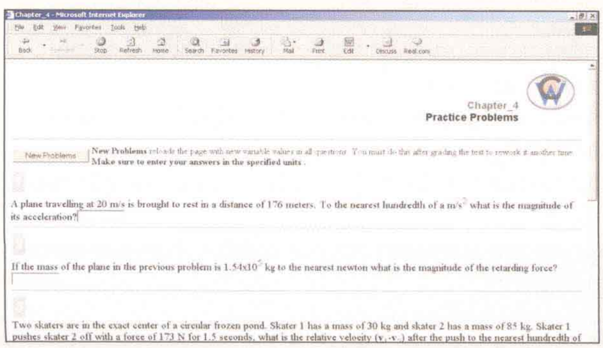
by Glen Terrell (University of Texas at Arlington) and ARCO's MCAT Supercourse

For all relevant chapters, the MCAT Study Guide module provides students with an average of 25 multiple-choice questions on topics and concepts covered on the MCAT exam. As with all multiple-choice modules, the computer automatically grades and scores student responses and provides cross-references to corresponding text sections.

Practice Problems

by Carl Adler (East Carolina University)

Ten algorithmically generated numerical **Practice Problems** per chapter allow students to get multiple iterations of each problem set for practice.



Destinations

Destinations are links to relevant Websites for each chapter, either about the physics topic in the chapter or about related applications.

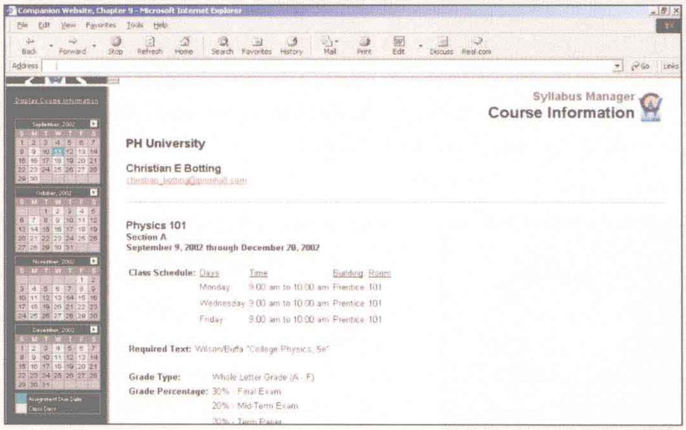
Solutions to Selected Exercises

by Bo Lou (Ferris State University)

Solutions to six selected exercises per chapter from Bo Lou's *Student Study Guide and Solutions Manual.*

Syllabus Manager

Wilson/Buffa's **Syllabus Manager** provides instructors with an easy, step-by-step process for creating and revising a class syllabus with direct links to the text's Companion Website and other on-line content. Through this on-line syllabus, instructors can add assignments and send announcements to the class with the click of a button. The completed syllabus is hosted on Prentice Hall's servers, allowing the syllabus to be updated from any computer with Internet access.



Ranking Task Exercises

edited by Thomas O'Kuma (Lee College), David Maloney (Indiana University–Purdue University, Fort Wayne), and Curtis Hieggelke (Joliet Junior College)

Available for most text chapters as PDF files downloadable from the Wilson/Buffa Website, **Ranking Tasks** are conceptual exercises that require students to rank a number of situations or variations of a situation. Engaging in this process of making comparative judgments helps students reason about physical situations and often gives them new insights into relationships among various concepts and principles.

On-line Grading

Scoring for all objective questions and problems, as well as responses to essay questions, can be e-mailed back to the instructor.

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