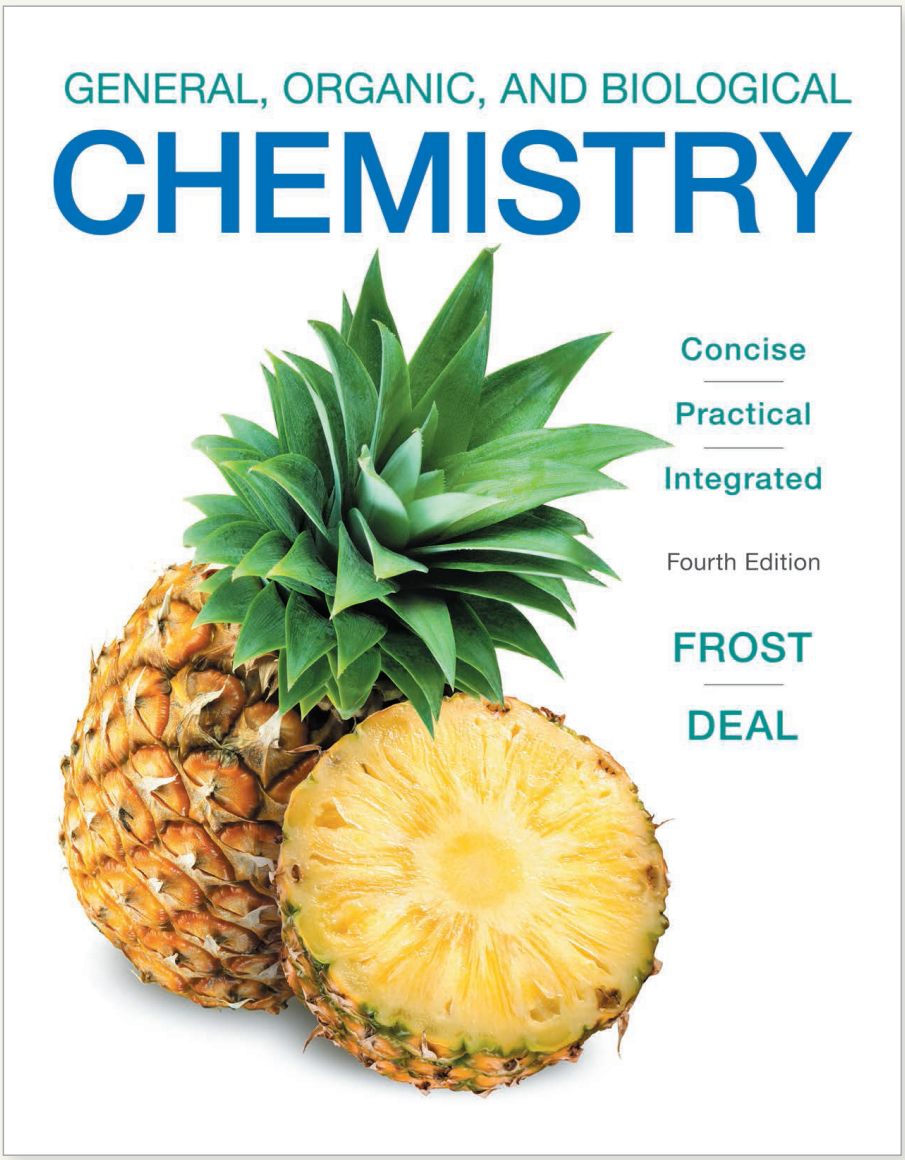
An integrated and applied approach to *General, Organic, and Biological Chemistry*

With the Fourth Edition of *General, Organic, and Biological Chemistry*, authors Laura Frost and Todd Deal apply their knowledge and experience in the science of learning to this focused, concise text. Practical connections and applications are highlighted, showing both allied-health and non-science majors how to use their understanding of chemistry in future health professions and in their everyday lives. Enhanced digital tools in Mastering Chemistry and embedded in the Pearson eText guide students through all stages of the course, providing support when and where students need it.



Pearson

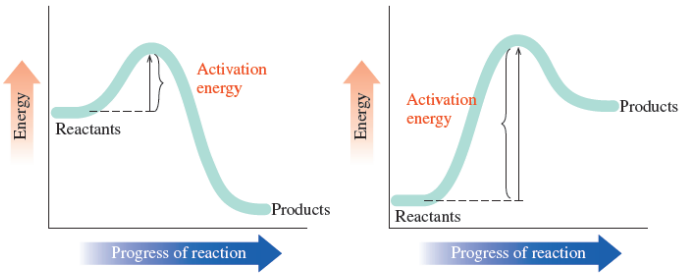
Apply the science of learning to the way students learn

DISCOVERING THE CONCEPTS

INQUIRY ACTIVITY—Reaction Energy Diagrams

Information

The diagrams shown are called reaction energy diagrams and graphically show the progress of two different chemical reactions on the *x*-axis and the amount of energy required as the reaction moves forward on the *y*-axis. The *activation energy* is the amount of energy required to get the reactants into position for collision with enough energy so that they react. Reactions with larger activation energies occur more slowly than reactions with smaller activation energies.



Questions

1. Which reaction has the larger activation energy?
2. Based on the diagrams, which reaction can form products more quickly?
3. A *catalyst* speeds up a chemical reaction by lowering the activation energy. Sketch diagram A and draw a second line on the same diagram for the reaction when a

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UPDATED! Discovering the Concepts can be used to engage students in groups during class as they construct an understanding of the content in cooperation with their peers.

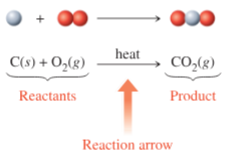
Activity: Balancing Chemical Equations

Learning Objectives

Balance a simple chemical equation

Information

Scientists use chemical formulas as a short-hand to represent substances made from the elements. Similarly, a chemical equation is used to represent how substances change during a chemical reaction.



Scheme 1. Basic parts of a chemical equation.

Questions

1. a. Fill in the following table for Scheme 1.

Element	Number in Reactants	Number in Product
Carbon		
Oxygen		

b. How is the number of each element in the reactants of a chemical equation related to the number of each element in the product?

Guided Inquiry Activities, authored by Laura Frost, engage students with more of the topics in the textbook through exploration, concept development, and application. These Activities are available in the Mastering Instructor Resources.

Relate chemistry to students' future careers

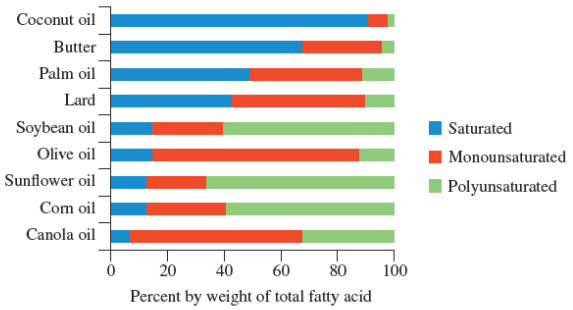
INTEGRATING Chemistry

Find out how the fatty acids in coconut oil are different from those in other oils.

Fatty Acids in Our Diets

Fats are important in a balanced diet because they play important roles as insulators and protective coverings for internal organs and nerve fibers. Mono- and polyunsaturated fats are part of a healthy diet. The Food and Drug Administration (FDA) recommends that a maximum of 30% of the calories in a normal diet come from such fatty acid-containing compounds. The FDA also recommends that the majority of our fat intake come from foods containing a higher percentage of mono- and polyunsaturated fatty acids. **TABLE 4.6** shows the fatty acid composition of some common fats. Highly saturated oils like coconut and palm oils have found uses as natural substitutes for hydrogenated oils, which are chemically saturated. More about hydrogenated oils is found in Chapter 5.

TABLE 4.6 Fatty Acid Composition of Common Dietary Fats



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EXPANDED! Topics focused on health science emphasize that good health and science literacy are critical for everyone and appear throughout the text. Examples include two new Integrating Chemistry features covering common viral diseases and gluten sensitivity.

Health-Related Problems are integrated throughout each chapter and are tied to real-life applications from allied-health fields, helping to promote critical thinking skills and to connect the chemistry learned with their future professions.

Additionally, **clinical examples** throughout the text pay particular attention to topics such as acid-base and biochemistry.

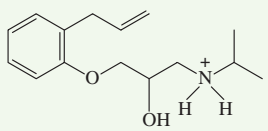
Practice Problems

9.53 The antihypertensive medication alprenolol is shown as an acid below. The pK_a for the acid is 9.6.

a. Which form is charged: acid, conjugate base, or both?

b. Which form (acid, conjugate base, or both) will predominate in a stomach with a pH between 1 and 3?

c. Which form, acid or conjugate base, will be able to more easily diffuse through a cell membrane?



Alprenolol, an antihypertensive, $pK_a = 9.6$

9.54 The anticonvulsant medication valproic acid is shown as an acid below. The pK_a for the acid is 4.8.

a. Which form is charged: acid, conjugate base, or both?

b. Which form (acid, conjugate base, or both) will predominate in the first part of the small intestine (jejunum), where the pH is between 6 and 7?

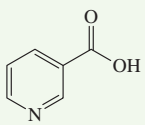
c. Which form, acid or conjugate base, will be able to more easily diffuse through a cell membrane?

9.55 Consider the vitamin niacin, which has a pK_a value of 4.85.

a. Will the acid or the conjugate base predominate at the following pH values: 3.00, 4.85, and 7.40?

b. At each pH, is that form charged or uncharged?

c. Calculate the ratio of [c. base]/[acid] present at each pH.



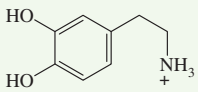
Niacin, $pK_a = 4.85$

9.56 Consider the neurotransmitter dopamine, which has a pK_a value of 8.90.

a. Will the acid or the conjugate base predominate at the following pH values: 7.45, 8.90, 13.40?

b. At each pH, is that form charged or uncharged?

c. Calculate the ratio of [c. base]/[acid] present at each pH.



Dopamine, acid form, $pK_a = 8.90$

9.57 Procaine and lidocaine are used to numb the gums during dental procedures. Procaine has a pK_a of 9.1, whereas lidocaine has a pK_a of 7.9. Which do you think will relieve pain faster in the gums? Explain.

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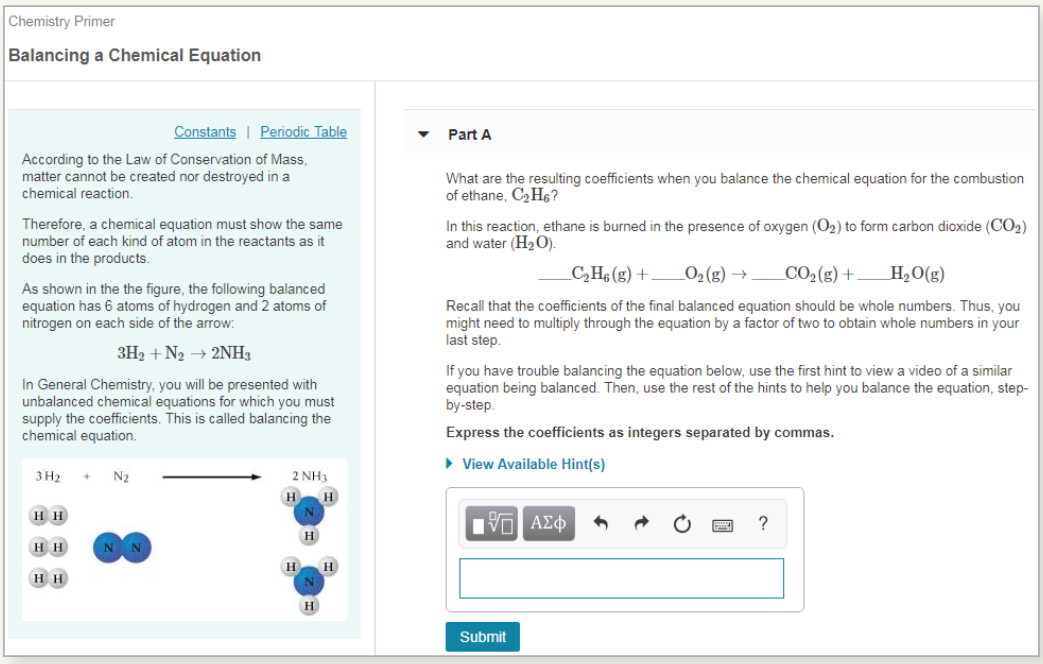
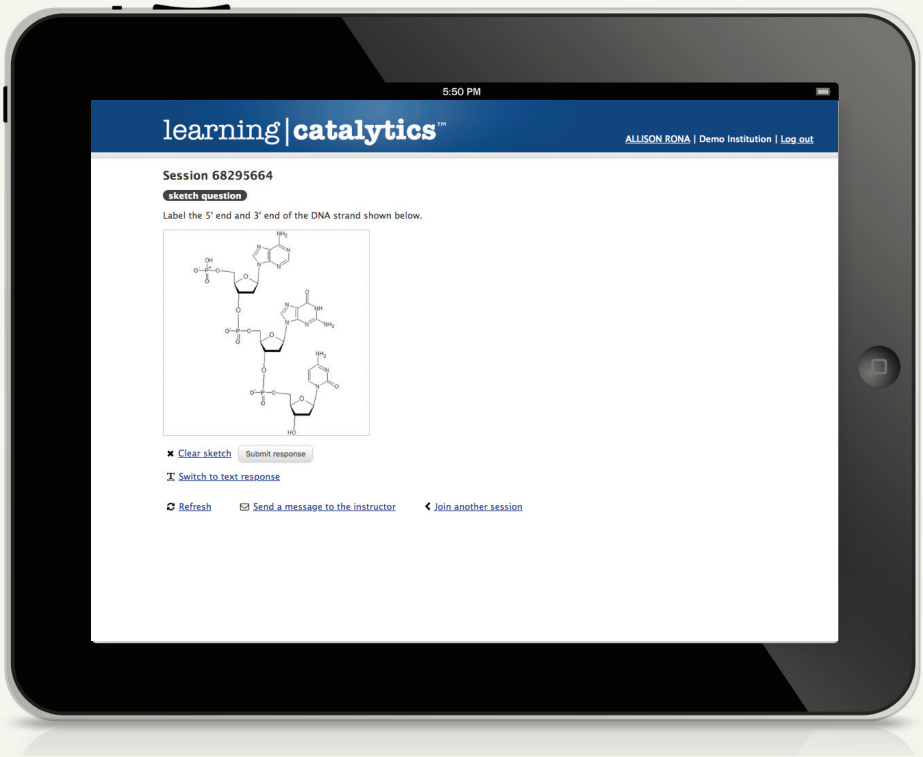
Reach every student . . .

EXPANDED! 11 new Practicing the Concepts videos explain major concepts that students struggle with in the chapter. The videos are 3–5 minutes long and are narrated by author Todd Deal, with video assessment questions written for use in Learning Catalytics, the Pearson eText, and assignable in Mastering Chemistry.

The Chemistry Primer in Mastering Chemistry helps students remediate their chemistry math skills and prepare for their first college chemistry course. Scaled to students' needs, remediation is only suggested to students that perform poorly on an initial assessment. Remediation includes tutorials, wrong-answer specific feedback, video instruction, and stepwise scaffolding to build students' abilities.

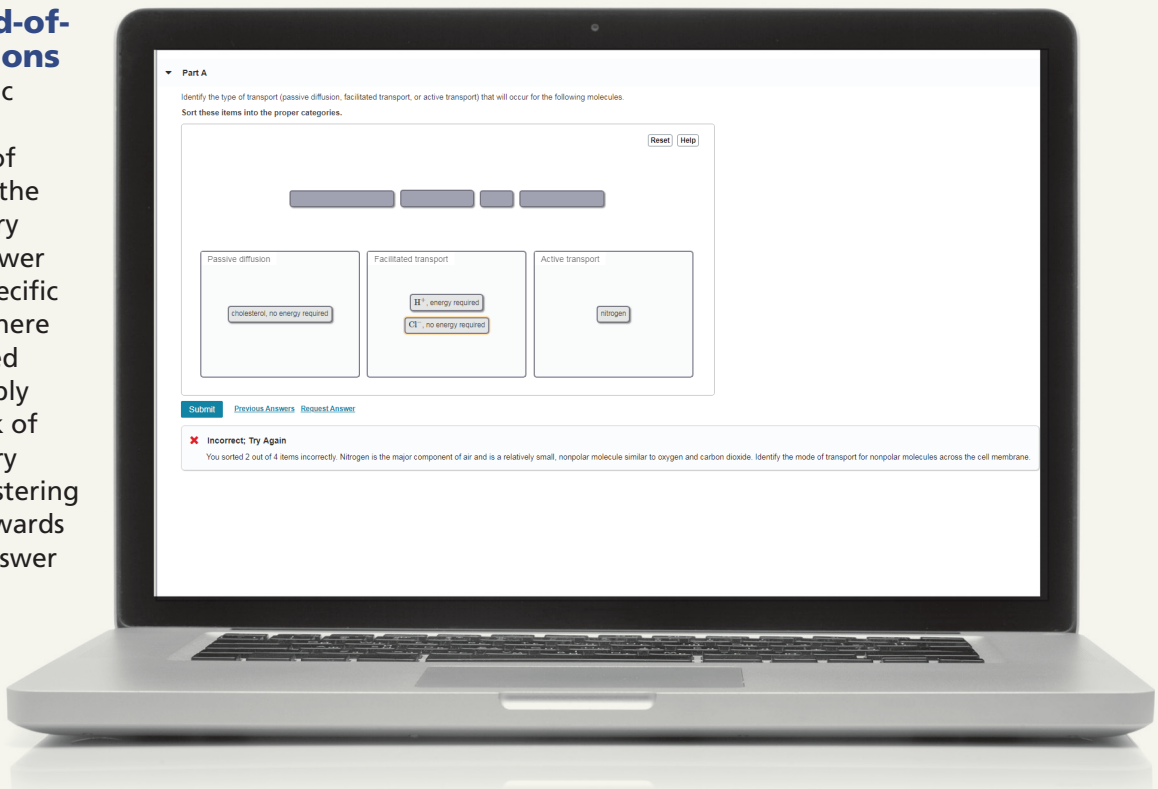


with Mastering Chemistry



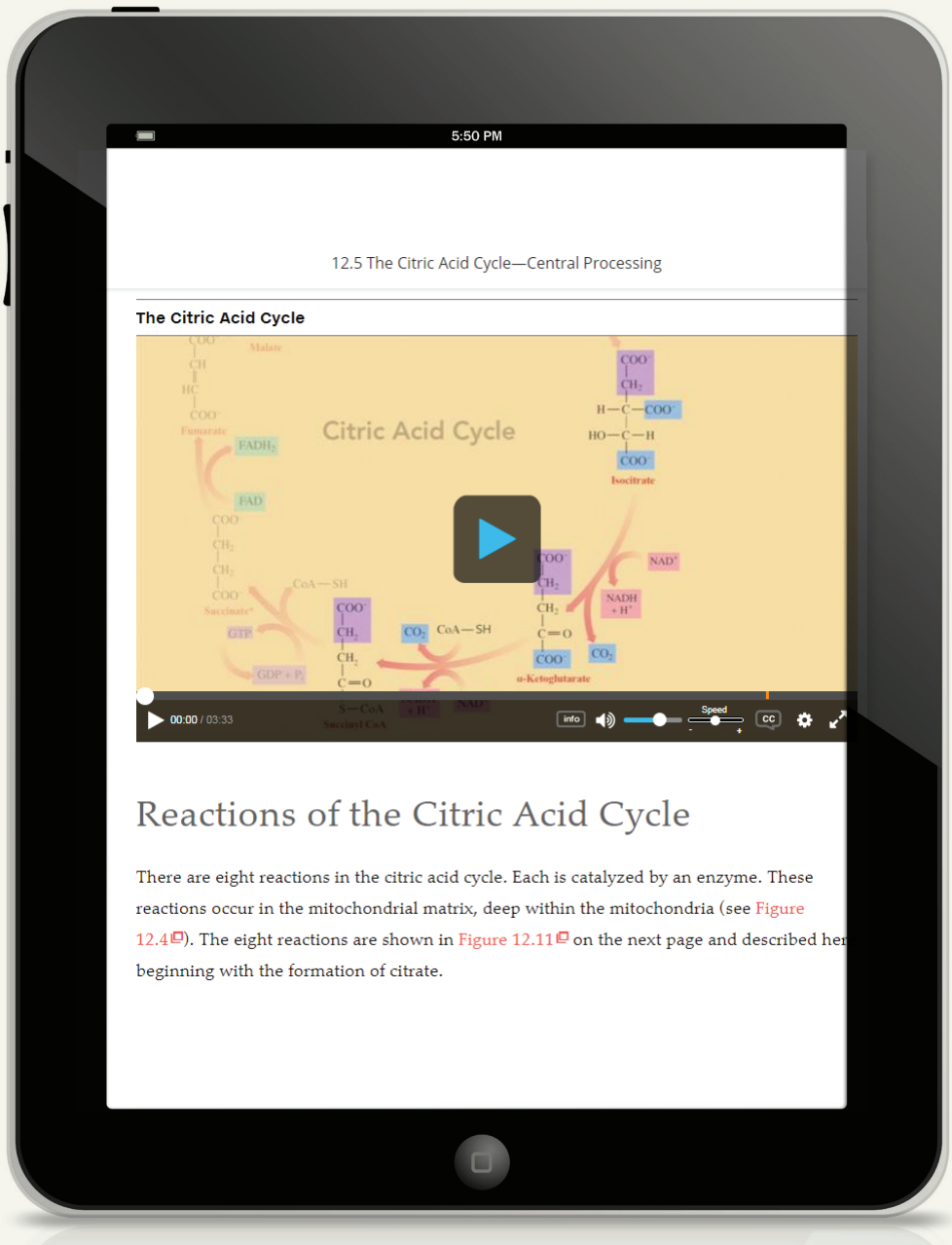
With Learning Catalytics, you'll hear from every student when it matters most. You pose a variety of questions that help students recall ideas, apply concepts, and develop critical-thinking skills. Your students respond using their own smartphones, tablets, or laptops. You can monitor responses with real-time analytics and find out what your students do—and don't—understand, to help students stay motivated and engaged.

ENHANCED! End-of-chapter questions with answer-specific feedback use data gathered from all of the students using the Mastering Chemistry to offer wrong-answer feedback that is specific to each student, where and when they need it. Rather than simply providing feedback of the "right/wrong/try again" variety, Mastering guides students towards the correct final answer without giving the answer away.

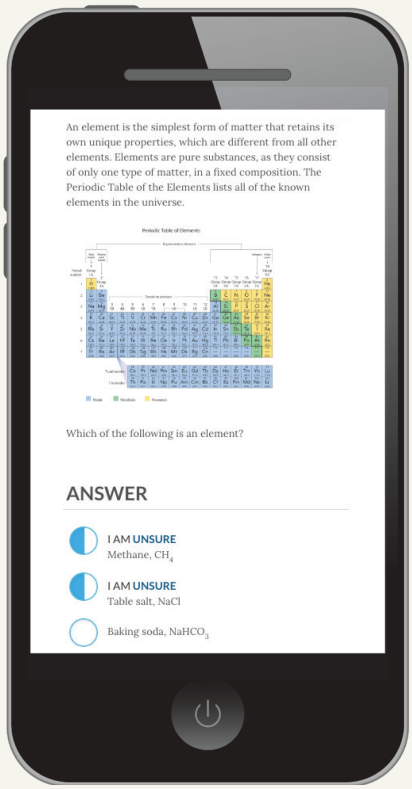


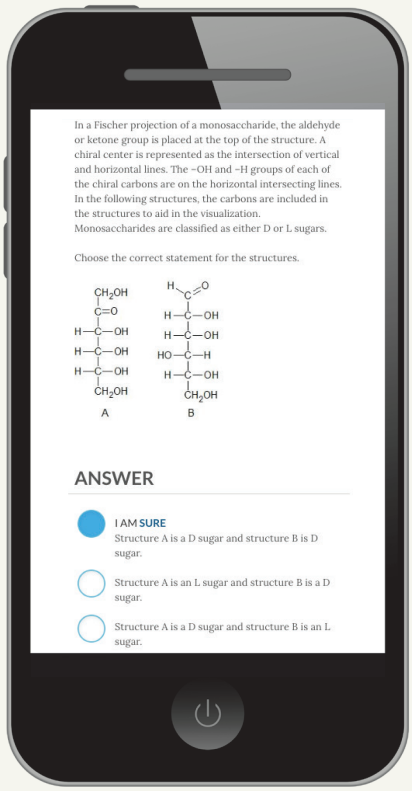
Give students anytime, anywhere access with Pearson eText

Pearson eText is a simple-to-use, mobile-optimized, personalized reading experience available within Mastering. It allows students to easily highlight, take notes, and review key vocabulary all in one place—even when offline. Seamlessly integrated videos, rich media, and embedded interactives engage students and give them access to the help they need, when they need it. Pearson eText is available within Mastering when packaged with a new book, as an upgrade students can purchase online, or can be adopted separately as your main course material.



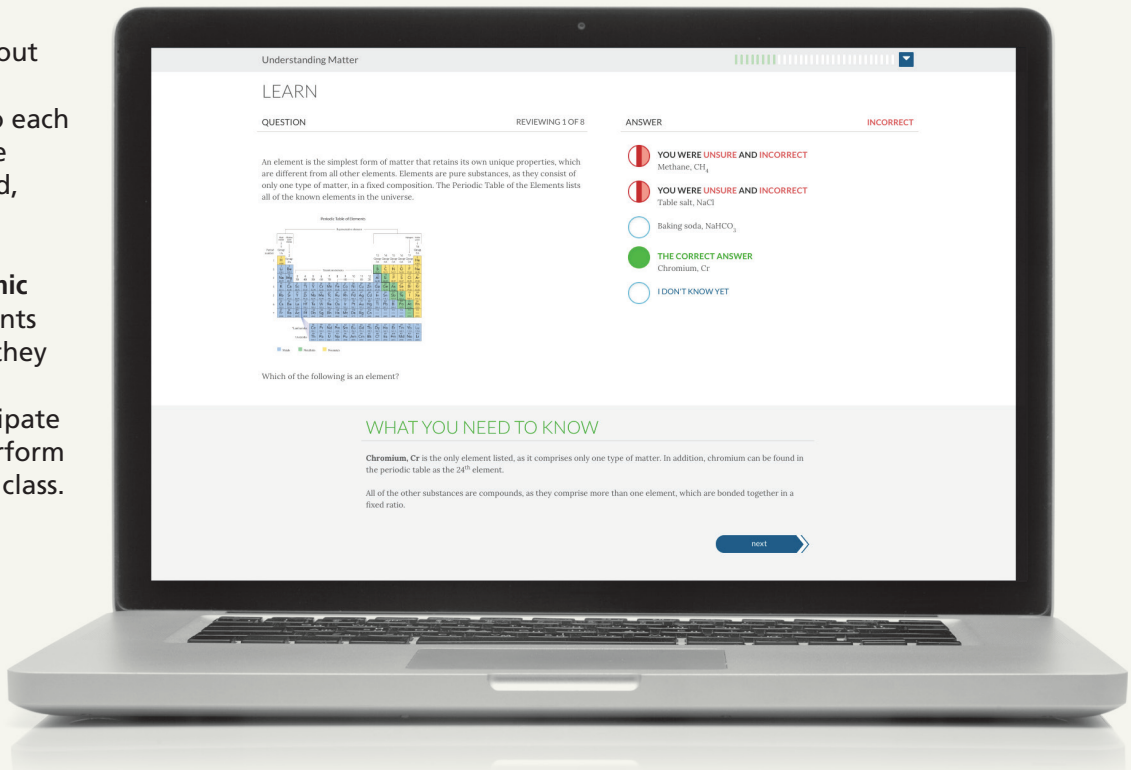
Improve learning with Dynamic Study Modules





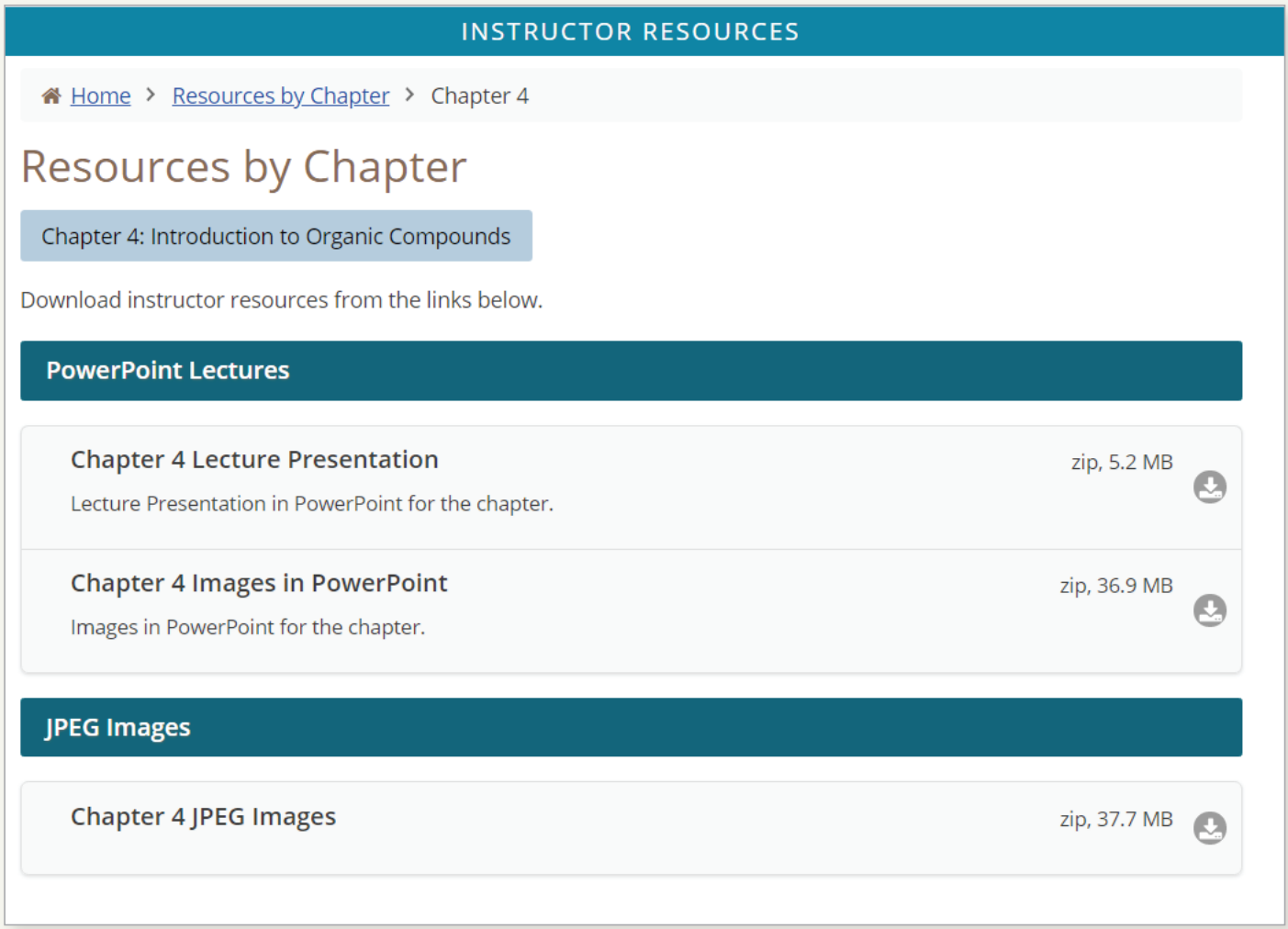
Dynamic Study Modules in Mastering Chemistry help students study effectively—and at their own pace—by keeping them motivated and engaged. The assignable modules rely on the latest research in cognitive science, using methods—such as adaptivity, gamification, and intermittent rewards—to stimulate learning and improve retention.

Each module poses a series of questions about a course topic. These question sets adapt to each student's performance and offer personalized, targeted feedback to help them master key concepts. With **Dynamic Study Modules,** students build the confidence they need to deepen their understanding, participate meaningfully, and perform better—in and out of class.



Instructor support you can rely on

General, Organic, and Biological Chemistry **includes instructor support materials in the Instructor Resources area in Mastering Chemistry. Resources include customizable PowerPoint lecture presentations and all images in JPEG format.**



Preface

To the Student

How does the body regulate carbon dioxide levels? Why are some pharmaceuticals injected and others taken orally? The key to understanding the answers to these questions starts with chemistry.

General, Organic, and Biological Chemistry was written especially for students interested in pursuing a health science career like nursing, nutrition, dental hygiene, or respiratory therapy. Yet this textbook has applications for all students interested in discovering the concepts of chemistry in everyday situations. Throughout the text, you will find that we have integrated the concepts of general, organic, and biological chemistry to create a seamless framework to help you relate chemistry to your life.

One of our goals in writing this book is to help you become better problem solvers so that you can critically assess situations at your workplace, in the news, and in your world. In this edition, we have kept the problem-solving strategies while increasing their depth to encourage greater understanding.

As you explore the pages of this book, you will encounter materials that

- apply chemistry to your life
- apply chemistry to health careers that interest you
- encourage you to develop problem-solving skills
- help you to work with and learn from your fellow students
- demonstrate how to be successful in this chemistry course and other courses.

As you read this book, you will notice that the language is less formal. Wherever possible, we relate the chemical concepts to objects in everyday life to help you understand chemistry. We also provide several study strategies with this edition, including materials for you to engage with before, during, and after class. Cognitive research in learning tells us that new ideas stick with us better if they are related to things that we already know and if we practice retrieving this information from our memories.

New to This Edition

The Fourth Edition continues to strengthen our strategy of integrating concepts from general, organic, and biological chemistry to give students a focused introduction to the fundamental and relevant connections between chemistry and life. With an emphasis on developing problem-solving skills, guiding the students' reading through Inquiry Questions, and helping students retain information through iterative retrieval practice, this text empowers students to solve problems in applied contexts relating to health and biochemistry.

- Each chapter now begins with a Learning Tip relevant to the chapter content. As students acquire the Learning Tips throughout the book, they can become more independent learners. The Learning Tips are rooted in the cognitive science literature and are supported with a list of references in the Credits section.
- While the order of chapters remains the same, some sections within the chapters have been reorganized for the better flow of concepts. In Chapter 1, we moved Section 1.6 (How Matter Changes) up to follow Section 1.2, before we begin significant figures and unit conversion. Chapter 7 now begins with Gases and Gas Laws prior to discussing attractive forces and the physical properties of liquids and solids.
- This edition includes an increased number of problems stamped with the health icon to highlight health applications of the chemistry content, making the book more relevant for students in the health professions.
- The biochemistry applications offer even more depth than the Third Edition, providing new content on drug solubility and delivery, peptides in celiac disease, common viral diseases, and CRISPR.
- We created new Practicing the Concepts videos for this edition. Each chapter now has two supporting videos. The videos, which run from 3 to 5 minutes, feature author Todd Deal. In the videos, he reviews a big idea or concept from the chapter, then helps students deepen their knowledge and develop their skills. Carefully developed visuals portray concepts vividly, and a pause-and-predict stopping point gives the student a chance for a meaningful concept check.
- Every chapter has been revised, including the sample problems and practice problems. To support areas of chapters with expanded coverage, we added new practice problems.

To the Instructor

Actively Engaging Your Students with Discovering the Concepts

From Laura Frost

Each chapter in *General, Organic, and Biological Chemistry* contains at least two guided inquiry activities, called Discovering the Concepts, at the beginning of some sections. These activities are offered to engage students in groups during class as they construct an understanding of the content in cooperation with their peers. Active learning strategies that include Discovering the Concepts have been shown to increase engagement, learning, and retention (see Freeman et al., 2014). All the information necessary to answer the questions in the activity is included at the beginning of the activity, so students should not need to use other parts of their textbook. An outline of some key points regarding the use of these activities follows.

Facilitation Faculty can facilitate the use of these activities by managing class time, guiding students to the correct answers instead of giving them the correct answers, and interjecting information during the group work where appropriate to guide student learning. It is also important for the instructor to be familiar with the activity in advance, to anticipate where students might struggle with the questioning.

Organizing Groups Faculty new to active learning often have questions about organizing student groups: Should I assign students to particular groups? Should I let students pick their own groups? Should I rotate the groups during the term? Because this course is an introductory course with few (if any) prerequisites, random assignment on the first day of class can suffice. However, I encourage diversification by gender, ethnicity, and problem-solving strategies whenever possible. With few exceptions, I have found that students become comfortable with their group members and almost insist on staying in the same group. That being said, I have met many colleagues who use active learning strategies who do rotate groups. This too can be a successful approach, with the caveat that instructors must inform students of their intention to rotate groups well in advance. Some faculty members rotate groups after an exam, some rotate them more frequently, and others keep the same groups for the entire semester. More information on group work can be found in CBE Life Sciences Evidence-Based Teaching Guide on Group Work (Wilson et al., 2018).

Skill Development Encourage students to review and extend their understanding by completing problems outside of the classroom. The practice problems at the end of each textbook section, and the additional problems and challenge problems at the end of the chapters, are ideal for this purpose.

Group Accountability To develop skill in written communication, it is essential that a record be kept of the students' activities during the class period by a student acting as group recorder. Other roles such as group manager, presenter, and technician should also be considered to keep the groups on task. An instructor may choose to grade some, all, or none of the activity, or assign participation points during the class period. However you choose to do it, group accountability should be incorporated into your grading scheme in some form.

Individual Accountability Some form of individual understanding of the activity should also be a part of the assessment. This can be done through quizzing, which also encourages skill development and retrieval practice. I give a short quiz at the beginning of a class based on the activity from the previous class. Quizzing can be done online, as a clicker quiz (works well in large classes), or on paper. The quiz should be reviewed immediately after students complete it, offering some teachable moments for student understanding.

To be efficient, the quizzing process should take no more than 10 minutes of the class period. Quizzing also has the effect of increasing student attendance and decreasing student tardiness if done at the beginning of the class. Individual accountability can also be assessed through monitoring homework, either online or on paper.

Metacognition To bring their learning full circle, students must reflect on their own learning. I provide groups with a feedback sheet that is to be completed at the end of class by one of the members of the group. The purpose of this reporting is to have students assess what they did and did not learn during the class period. The wording can be general, or changed to reflect the contents of the activity, but should provide the instructor with feedback regarding the effectiveness of the activity. The following general items are suggested for inclusion in the feedback sheet:

- List the primary topic(s) that you learned during today's activity.
- Is there anything that is still not clear regarding today's activity? Please be specific.

Many instructors are concerned with covering the required material in a course, and wonder whether an active classroom will slow the pace of coverage. I offer two thoughts related to this very real concern:

1. Because the activities help students develop problem-solving and critical-thinking skills, students are better able to apply the learned knowledge to related topics not explicitly taught in class. For example, identifying functional groups does not mean that the instructor must show the students all common functional groups in class (as may be done in a lecture). Once the concept of organic families and functional groups is introduced, students should be able to use a table to identify other functional groups, thereby maximizing instructional time in the classroom.
2. Just because a lecturer covers a topic in the classroom does not mean that a student learned it. In fact, faculty members are regularly amazed at the lack of knowledge retention from one course to the next.

I invite you to try Discovering the Concepts. If you find that these activities are helpful in engaging and reaching students, you may want to explore the full set of activities at pearsoncustomlibrary.com for use with the textbook.

I have been field-testing and revising these activities with students since 2006. My own course-based research has shown that students who use these activities perform better on the final exam and have a deeper understanding of the material (as measured by the learning level of the questions they are capable of answering) than students in my courses prior to my use of guided inquiry activities (Frost, 2010). I welcome your comments and questions at lfrost@fgcu.edu regarding their use.

Guiding Student Reading Using the Inquiry Questions

You may have noticed the Inquiry Question ? at the beginning of each section, which encapsulates the main learning goal for that section of text. Although these questions may seem obvious to the instructor, they can provide powerful guidance for the novice learner if you point them out as study strategy. Students can use these questions to guide their reading. I recommend suggesting that as they read, they jot down notes that might help to answer the Inquiry Question by the

end of that section. This form of self-explanation is very useful for student retention and understanding. Research shows that when students who are less structured in their studies and think more concretely use embedded questions to guide their reading, they can retain information longer than students who don't use embedded questions (Callendar & McDaniel, 2007).

Chapter Organization and Revision

Throughout the text, we integrated general, organic, and biological chemistry topics using relevant examples and applications to solidify concepts. This text intentionally contains only 12 chapters, allowing all chapters to be covered in a single semester. Each chapter builds upon conceptual understanding and skills learned from previous chapters, providing students with an efficient path through the content and a clear context for how all of the topics connect to one another.

In this edition, at least a quarter of the chapter problems are new or have been modified. We also made extensive chapter revisions as discussed below.

1 Chemistry Basics—Matter and Measurement

- Former Section 1.6, How Matter Changes, has been moved to appear earlier in the chapter, since physical changes and chemical reactions naturally flow from understanding the nature of matter.
- The periodic table has been updated to include all elements to 118.
- The significant figures discussion in Section 1.4 now uses readings on a syringe and a digital thermometer in the discussion of measuring.
- The content on nutrition labels has been updated to reflect recent changes to nutrition labeling.

2 Atoms and Radioactivity

- The more common unit *millirem* is used to describe the biological effects of radiation.
- The Integrating Chemistry feature on "Radioisotopes and Radiation in Cancer Treatment" is expanded to include proton therapy and neutron capture therapy.

3 Compounds—How Elements Combine

- A new Solving a Problem feature, "Drawing Lewis Structures," has been added to Section 3.4.
- Table 3.7 has been updated with examples of molecules showing the preferred bonding patterns for carbon.

4 Introduction to Organic Compounds

- The chapter has been updated throughout to add a focus on the structural aspects of organic chemistry.
- The Integrating Chemistry feature "Pharmaceuticals Are Organic Compounds," has been completely rewritten with a focus on opioids.
- The Integrating Chemistry feature "Fatty Acids in Our Diets" has been updated to include recent research findings.
- The discussion of chiral molecules has been rewritten to focus on limonene.

5 Chemical Reactions

- Expanded thermodynamics coverage in Section 5.1 now includes the terms enthalpy, entropy, as well as Gibbs free energy.
- Section 5.5 now includes content on hydrolyzable and nonhydrolyzable lipids.
- The analogy used to explain equilibrium reactions has been updated for clarity.

6 Carbohydrates—Life's Sweet Molecules

- New Table 6.1 provides Fischer projections and names for D-monosaccharides containing three to six carbons, with the highest numbered chiral center highlighted.
- New Figure 6.16 consolidates the storage and structural polysaccharides into a single figure, so students can more readily compare and contrast the structures.

7 States of Matter and Their Attractive Forces: Gas Laws, Solubility, and Applications to the Cell Membrane

- The revised chapter title highlights the new conceptual balance of the chapter.
- Gas laws have moved to the beginning of the chapter.
- Section 7.1 has been expanded to include the kinetic molecular theory of gases.
- In Section 7.2, the introduction of attractive forces has been streamlined, using boiling point and vapor pressure as concrete examples.
- In Section 7.3, the content on solubility has been updated to include the terms *hydrophobic* and *hydrophilic* when referring to aqueous solutions.

8 Solution Chemistry—Sugar and Water Do Mix

- The new chapter title asks the student to look to the chapter for answers about solutions.
- The "Unique Behavior of Water" section has been updated to include coverage of specific heat.
- A reference to osmolarity in Section 8.6 connects the new concentration units to ones familiar to the student.

9 Acids, Bases, and Buffers in the Body

- Chapter 9 now has more pharmacologically relevant problems.
- Section 9.7 now discusses the relationship between pH and pK_a in terms of drug solubility and diffusion.

- A new Integrating Chemistry feature focuses on the role the kidneys and liver play in regulating CO_2 levels.
- The Henderson-Hasselbalch equation has been added to Section 9.7 as a tool for determining the ratio of conjugate base to acid.

10 Proteins—Workers of the Cell

- The discussion of amino acids as weak acids is positioned in Section 10.1 to reinforce the relationship between pH and pK_a from Chapter 9.
- A new Integrating Chemistry feature describes the role of peptides in celiac disease.

11 Nucleic Acids—Big Molecules with a Big Role

- In new Figure 11.11, the genetic code is presented using a genetic wheel instead of a table.
- A new Integrating Chemistry feature takes a closer look at common viruses.
- A new discussion of CRISPR has been added to Section 11.8.

12 Food as Fuel—An Overview of Metabolism

- New problems shift the focus toward problem solving.
- Updated art better represents the protein structures in the electron transport chain.
- Section 12.8 includes updated information on protein metabolism.

Acknowledgments

We have learned much since the first edition was published. Faculty and reviewer feedback has allowed us to enhance the Fourth Edition with some much-needed coverage while keeping the book length reasonable for a one-semester course.

The editorial staff at Pearson has been exceptional. We are extremely grateful for the assistance of Mary Ann Murray, Senior Analyst, Content Development, whose fresh eyes on the content allowed for clarity from the student perspective. Her years of textbook development were apparent. We also want to welcome back Jessica Moro to the project, Senior Courseware Portfolio Analyst, whose patience and understanding are much appreciated. We greatly appreciate the efforts of Susan McNally, Content Producer, and Mary Tindle, Project Manager, who have gone through much of the material with a fine-tooth comb, making sure that author comments were interpreted correctly by production. Thanks also to Eric Schrader, Senior Manager, Rights and Permissions, and Ben Ferini, Manager, Rights and Permissions, for their efforts on the book. We want to thank other members of the production team, including Joanna Stein, Project Manager, and Joanna Dinsmore, copyeditor. They have been very patient with us throughout the production process.

Laura Frost would like to also thank Adam Jaworski, Senior Vice President, Portfolio Management–Science, for his continued support of this project, his shared vision that an actively engaged classroom can enhance student understanding of chemistry, and his support for the inclusion of the inquiry activities. She would also like to thank Jeanne Zalesky, Director of Portfolio Management, whose strong effort on the second edition continues to allow this textbook to thrive. She also recognizes the continued mentorship and friendship of Karen Timberlake in the area of GOB chemistry writing and publishing.

Todd Deal would like, once again, to express a special appreciation to Jim Smith, our original editor, whose enthusiasm for the integrated strategy used in this project and belief in us as authors provided the foundation upon which this text is built.

This text reflects the contributions of many professors who took the time to review and edit the manuscript and provided outstanding comments, help, and suggestions. We are grateful for your contributions.

In addition, this project could not have been completed without the support of several exceptional colleagues in the Department of Chemistry at Georgia Southern University and Florida Gulf Coast University, who have taught using this text and reviewed materials, offering many comments and corrections.

If you would like to share your experience using this textbook, as either a student or faculty member, or if you have questions regarding its content, we would love to hear from you.

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Resources in Print and Online

Supplement	Available in Print	Available Online	Instructor or Student Supplement	Description
Mastering Chemistry (ISBN: 0-13-517528-3 / 978-0-13-517528-6)		X	Instructor and Student Supplement	The Mastering platform delivers engaging, dynamic learning opportunities—focused on your course objectives and responsive to each student's progress—that are proven to help students absorb course material and understand difficult concepts. Practicing the Concepts videos with pause-and-predict quizzes in Mastering Chemistry bring chemistry to life. These 3- to 5-minute videos feature coauthor Todd Deal introducing key topics in general, organic, and biological chemistry that students find difficult. Students are asked to solve a problem while they watch the video content. Mastering also offers Learning Catalytics questions that directly relate to the content of the text. Learning Catalytics is a "bring your own device" student engagement, assessment, and classroom intelligence system.
Instructor Solutions Manual (ISBN: 0-13-559332-8 / 978-0-13-559332-5)		X	Instructor Supplement	This Solutions Manual provides detailed solutions to all in-chapter as well as end-of-chapter exercises in the text.
Test Bank		X	Instructor Supplement	This Test Bank contains over 600 multiple-choice, true/false, and matching questions. It is available in the TestGen program, in Word format, and is included in the item library of Mastering Chemistry.
Instructor Resources (ISBN: 0-13-559331-X / 978-0-13-559331-8)		X	Instructor Supplement	This provides an integrated collection of online resources to help instructors make efficient and effective use of their time. Includes all artwork from the text, including figures and tables in PDF format for high-resolution printing, as well as four pre-built PowerPoint™ presentations. The first presentation contains the images embedded within PowerPoint slides. The second includes a complete lecture outline that is modifiable by the user. Also available are PowerPoint slides of the parent text "in-chapter" sample exercises. Also includes electronic files of the Instructor's Resource Manual, as well as the Test Bank. Access resources through http://www.pearsonhighered.com/.
Study Guide (ISBN: 0-13-416051-7 / 978-0-13-416051-1)	X		Student Supplement	This manual for students contains complete solutions to the odd-numbered end-of-chapter problems in the text.
Laboratory Manual (ISBN: 0-32-181925-X / 978-0-32-181925-3)	X		Student Supplement	Written by T. Deal, the lab manual continues the strategy of integration of concepts to help students understand chemistry. Several of the experiments included in the lab manual are original works developed by Professor Deal and his students in support of the integrated strategy. Most experiments are designed around a question, which is intended to engage students and to demonstrate the applicability of chemistry concepts to real-world problems. Many of the experiments highlight concepts from multiple chapters of the text, once again building on the strategy of integration.
Guided Inquiry Activities (ISBN: 0-13-559337-9 / 978-0-13-559337-0)	X		Instructor and Student Supplement	Guided Inquiry Activities, authored by L. Frost, are available through the Mastering Instructor Resource Area. These activities are designed for in-class use by groups of students with facilitation by the instructor. Students explore information, develop chemical concepts, and apply the concepts to further examples.