INTRODUCTORY CHEMISTRY

KEVIN REVELL

SAMPLE CHAPTERS INSIDE
Chapter 6 Chemical Reactions
Chapter 7 Mass Stoichiometry
KEVIN REVELL teaches introductory, general, and organic chemistry at Murray State University, and also serves as the assistant dean for the MSU Jones College of Science, Engineering, and Technology. A passionate educator, his teaching experience includes high school, community college, small private, state comprehensive, and state flagship institutions. His work encompasses curriculum, technology-enhanced pedagogy, assessment, and active-learning design. He has hosted multiple science education workshops, and is the senior editor for flippedchemistry.com, an online community for college-level instructors implementing active-learning pedagogies. A synthetic chemist by training, his research involves the synthesis and evaluation of functional organic materials. With his wife, Jennifer, Kevin has three children—James, Julianne, and Joshua—and two grandchildren.

Welcome to Introductory Chemistry!

For many students, introductory chemistry is a general-education requirement en route to a degree in education, business, or a liberal-arts field. For others, it is a stepping stone toward a challenging general chemistry course and a career in healthcare, agriculture, or even science and engineering. Some are traditional students, but many others are non-traditional students balancing jobs, family, and the dream of completing a college degree. And for many, chemistry can seem elusive, mystical, and intimidating.

My vision is to make chemistry accessible to these students, not just through a textbook, but through an integrated learning experience that addresses different learning styles and draws on a variety of pedagogical techniques to engage and challenge students.

Let’s begin with the text. I’ve tried to write in a friendly, casual style—using analogies, stories, and images to make the important ideas stick. I’ve blended this with digital interactives to create an active reading experience. In some of these interactive figures, you can explore chemical changes, choosing different substances to see how they react. In others, you’ll be able to practice key knowledge and skills through simple games.

For instructors, Introductory Chemistry is more than a textbook—it’s a complete curriculum, suited for traditional, flipped, or blended active-learning classrooms. I’ve created video lectures for every section, with corresponding PowerPoint decks that you can modify as you see fit. I’ve included in-class activities, clicker questions, and speed drills, developed over many semesters. Think of it as a tool belt, equipping you with the curriculum to suit the needs of your classroom.

The pages that follow describe many of these features in more detail. Whether you are teaching a class, taking a class, or just exploring chemistry for the first time, Introductory Chemistry is designed to help you achieve your goals. You can do this—let’s get started.

Best wishes,

Kevin Revell, Murray State University

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Building a Foundation with an Integrated Learning Experience.
At its core, Introductory Chemistry is the result of a unique author vision to develop a robust combination of text and digital resources that motivate and build student confidence while providing a foundation for their success. Kevin Revell knows and understands students today. His thoughtful narrative/video/interactive program works seamlessly to provide the most accessible and engaging set of resources for introductory chemistry available. The same author voice is mirrored in all print and digital content, allowing students flexibility and ensuring a fully supported learning experience—whether using a book or going completely digital!

Building a Foundation for Retention and Success.
Introductory Chemistry introduces students to chemistry with an exceptionally engaging writing style that not only promotes understanding but uses devices like storytelling and analogies to help students learn at a deeper level and retain concepts. Interactive activities and online tutorials offer students targeted, hands-on practice with the most difficult concepts in the course and provide a foundation for conceptual understanding and problem solving skills. Moving from comprehension to retention, students solidify their understanding of material to the point where they just “know it.”

Building a Foundation... Your Way!
Written and developed as a flexible print and digital resource, Introductory Chemistry is designed to serve as a teaching and learning tool to meet instructors and students where they are today and provide support and tools tailored to various learning and teaching styles. Introductory Chemistry comes with a full suite of traditional textbook and lecture resources to support a traditional lecture-based course, as well as resources that make the transition to a more active classroom easier for instructors interested in doing so. Instructors who already subscribe to active learning techniques will also find tools to complement their efforts. Students can choose to access the content in the learning environment that best fits their needs: the printed narrative and pedagogy, the eBook and interactive digital tools, the video lecture modules, or a combination.

““I love how seamless and intuitive this project is. It would be invaluable to professors who want to start trying a flipped classroom.”
— Chris Bradley, Mt. St. Mary’s University
Read or Watch Engaging Content

Kevin Revell’s exceptionally engaging and clear presentation of chemistry concepts is evident in both his writing style and in the prelecture videos he created to match every chapter and section of the text. Students can choose how they want to learn, whether by reading the book or by viewing the pre-lecture videos in SaplingPlus.

Read the book

Watch the Prelecture

"These videos are great. I love that they use some non-chemistry examples to relate students to the materials."

— Donna Gosnell, Valdosta College
**Visualizing Chemistry**

*Explore* icons identify text figures that have a digital component in SaplingPlus and are embedded in the eBook. These *animations and videos* help students better visualize chemistry concepts at the molecular level and show step-by-step processes to promote richer understanding.

*Guided inquiry interactives*: online tutorials and interactives allow students to explore chemistry concepts such as the interactions between two elements. Built-in guidance helps them recognize patterns and draw conclusions from the experience.

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**Developing Problem-Solving Skills**

A consistent problem-solving pedagogy and paired video explanations for EVERY practice problem in the text help build student confidence and provide scaffolding to strengthen their problem solving abilities. Unique tutorials guide students through the foundational math and chemistry skills that pose the greatest challenge.

*Try It, Check it, Watch Explanation* in-text problems encourage students to test their skills. In the eBook format, students can check their answer or watch a step-by-step video explanation, ensuring that each student has the tools necessary to address any misconceptions, anytime and anywhere.

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“A lot of students are visual learners and hands on. These interactives will be good practice. I also like that they can do them anytime, anywhere.”

— Chad Yuen, Augustana University

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Building a Strong Foundation...
For retention and success.

Kevin Revell’s inviting writing style presents Introductory Chemistry in an accessible manner that students can understand, using personal stories and a clear pedagogical framework to make the content memorable and sticky.

Storytelling and Analogies

Chapter-Opening Stories ground each chapter in stories of real people and how the chemistry concepts in the chapter are applied to real-world problems. Stories are revisited at the end of the chapter for a deeper understanding using what students have learned.

Personal Stories from Kevin use a friendly and welcoming tone to relate content to everyday life and encourage students to draw from their own experiences in thinking scientifically.

Units of Measurement

1. I love to make enchiladas (Figure 2.2). When preparing this meal, I follow a recipe that requires two pounds of roasted chili peppers, \( \frac{1}{4} \) cup of lime juice, and 1 teaspoon of salt (as well as other ingredients). After assembling the enchiladas, I bake them at a temperature of 350°F for 25 minutes.

   ![Figure 2.2](image)

   Enchilada night in the Revel household is a great tradition. For the meal to come out right, the ingredients must be measured correctly.

2. Finding the Leftovers

   In the previous section we used a sandwich recipe as an analogy for a chemical reaction:

   \[ 2 \text{ slices of bread} + 1 \text{ slice turkey} + 1 \text{ slice cheese} \rightarrow 1 \text{ sandwich} \]

   Based on this equation, we said that if we have 18 slices of turkey, 15 slices of cheese, and 80 slices of bread, we can make 15 sandwiches. The cheese is the limiting reagent. But here’s another question: If we make all of the sandwiches, how many slices of turkey and of bread will be left over? I encourage you to take a moment and try to figure this out before moving forward.

   To solve this problem, we first find the amount of each reagent (ingredients) that we used. Following the rates in the balanced equation, we would summarize our sandwich making as follows:

   - Used: 90 slices of bread, 15 slices of turkey, 15 slices of cheese
   - Produced: 15 sandwiches

   To find the leftovers, we subtract what we used from our initial amounts:

   - Bread: 86 slices – 90 slices = 54 slices left over
   - Turkey: 10 slices – 15 slices = 5 slices left over
   - Cheese: 15 slices – 15 slices = 0 slices left over (limiting reagent)

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Chemical Reactions

Lost Cities of the Maya

CHAPTER SIX

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Analogy: "Building a Strong Foundation..."
Framework for Learning and Retention

**Intended Learning Outcomes** at the beginning of each chapter prepare students for the chapter’s content.

**Key Terms** are listed at the end of each chapter. In the eBook, key terms in the chapter link directly to the definition for easy access while reading.

**Foundational Math and Chemistry Skills**

**Quick Recall Activities** focus students on drilling the information in chemistry that they must memorize to achieve success, such as identifying ionic charges. A gamelike interface fosters a low-stakes and fun practice environment.

**Guided Practice** online tutorials provide extra, hands-on practice with the most difficult concepts in the course, such as unit conversion and balancing charges, and provide a foundational understanding for future work in chemistry.

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I really love the way this is written. I love the real world examples. The ‘why’ aspect of chemistry comes alive here.”

— Mary Smith, Johnson College
Free Up Class Time with Lecture Videos

Lecture Videos All content from the written text is also represented in videos created by Kevin, so instructors can easily flip their classroom and students can watch videos alongside of reading.

Building a Strong Foundation... In the classroom.

Kevin Revell found that incorporating active learning into his classroom improved the experience for him and for his students—he also found that this can be a difficult and time-consuming process and is not for everyone. For instructors looking to infuse some forms of active learning, Introductory Chemistry includes a complete set of pre-lecture videos to provide more flexibility with lecture time and activities you can use to help get started or complement your active learning approach.

FlippedChemistry.com

FlippedChemistry.com is a community started by Kevin Revell to share ideas and resources for creating a more active chemistry classroom. Kevin has recently been named one of the top 40 Flipped Learning leaders in higher education across the world by the Flipped Learning Global Initiative.

Covalent Bonding

\[
\text{F} + \text{F} \xrightarrow{\text{two electrons shared}} \text{F} \cdot \text{F} \rightarrow \text{F} - \text{F}
\]
In-Class Activities

iClicker Questions provide instructors with ready-made assessments for use in the classroom to evaluate student learning in real time.

Speed Drills challenge students’ memory of foundational knowledge. When used as a timed self-assessment in the classroom, students are motivated to improve.

In-Class Activities and Worksheets keep students engaged during class by providing problems for them to try on their own.

Skeletals provide students with a pared down set of lecture slides for taking notes, allowing them to associate their own thoughts and questions with provided figures and exercises.

Integrated with iClicker

iClicker Active Learning Simplified

In-Class Activities with iClicker
iClicker offers simple, flexible tools to help you give students a voice and facilitate active learning in the classroom. Students can participate with the devices they already bring to class using our iClicker Reef mobile app (which works with smartphones, tablets, or laptops) or iClicker remotes. We’ve now integrated iClicker with Macmillan’s Sapling Learning and Kevin has authored in-class activities to be used with iClicker. With Revell, Introductory Chemistry with iClicker, it’s easier than ever to promote engagement and synchronize student grades both in and out of class.

iClicker access cards can also be packaged with Sapling Learning or your Macmillan textbook at a significant savings for your students. To learn more, visit iclicker.com or talk to your Macmillan Learning representative.

This is really great. I love the options and the way you present the information. It’s appropriate to the level of this course, written in a clear, concise, simple way. I’d totally love to use something like this!”

— Mandy Blackburn, University of Central Missouri

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SaplingPlus combines the new Revell, *Introductory Chemistry* integrated eBook, video program, and interactive resources with Sapling Learning’s innovative online homework for introductory chemistry. Sapling offers:

**Multiple question types** that enhance student engagement and understanding.

**Hints, targeted feedback, and detailed solutions** for all study questions to ensure student learning.

**Industry-leading peer-to-peer support** that pairs each instructor with a fully trained PhD- or Master’s-level colleague, ready to help with everything from quizzes and assignments to syllabus planning and tech support.

**SaplingPlus for Revell, *Introductory Chemistry* features:**

A **mobile-compatible, interactive eBook** with embedded lecture videos, animations, and problem solving videos.

**Lecture Videos** created entirely by Kevin Revell, covering all content from the written text so students can watch videos instead of reading and instructors can easily flip their classroom.

**Try It, Check It, Watch Explanation** videos that explain the solution to every in-text practice problem.

**Animations and Videos** that provide visuals for the most important concepts, as well as live representations of lab experiences such as chemical reactions.

**Guided Inquiry** tutorials and activities that allow students to explore chemical principles.

**Guided Practice** online tutorials offering extra, hands-on practice with the most difficult concepts in the course, as well as a foundational understanding for future work in chemistry.

**Quick Recall** activities that drill students on the information they must memorize to achieve success in introductory chemistry.

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“This textbook utilizes technology far better than anything I’m using currently. The ability for students to access the resources while in the textbook is a great tool.”

— Amy Norbutus, Rollins College

Photo Credit: Jacob Ammentorp Lund/Getty Images.
Hints attached to every problem encourage critical thinking by providing suggestions for completing the problem, without giving away the answer.

Targeted Feedback: each question includes wrong-answer specific feedback targeted to students' misconceptions.

Detailed Solutions: fully-worked solutions reinforce concepts and provide an in-product study guide for every problem in the Sapling Learning system.