NATIONAL GEOGRAPHIC

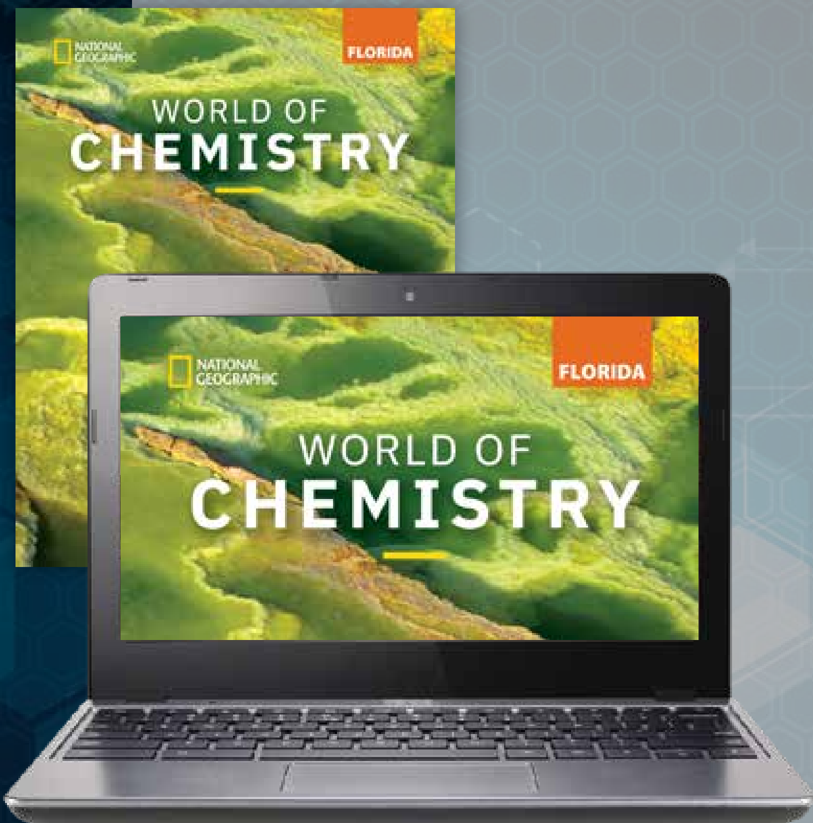
Florida Grades 9-12

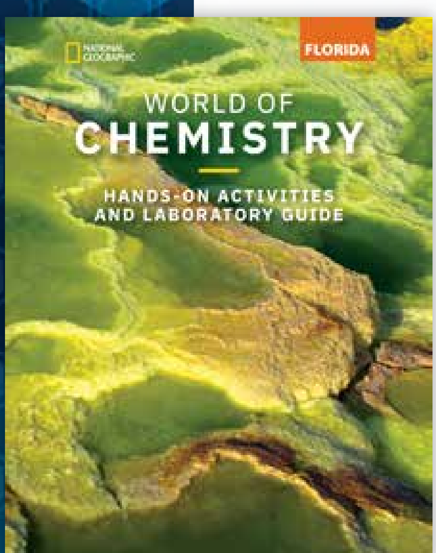
WORLD OF CHEMISTRY

Florida Edition

PUT STUDENTS AT THE CENTER OF CHEMISTRY LEARNING

Activate student curiosity and thinking with ***National Geographic Explorers*** and visuals that tell the story of how chemistry is critical to daily life. Each lesson provides multiple opportunities for students to build problem-solving skills through the exploration of science.





Get to the heart of “Why learn Chemistry?”

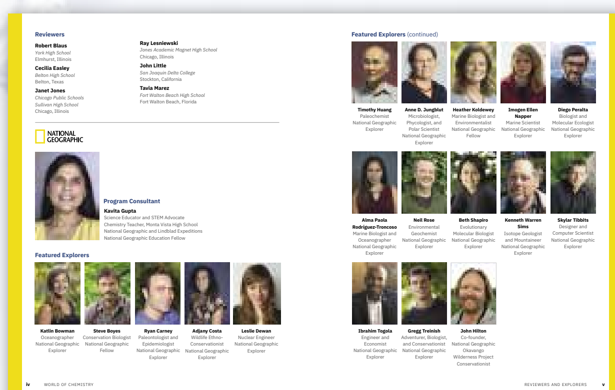
Students will think like chemists to create real-world solutions for projects in the *World of Chemistry Activity Guide, Florida Edition* activities inspire group discussions to help students get to the deeper meaning and importance of chemistry concepts.

Students use chemistry knowledge to design, build, and test solutions during four activity challenges.

Authentic National Geographic Experiences

World of Chemistry, Florida Edition makes chemistry real for students through the stories of scientists and National Geographic Explorers who show diverse perspectives in solving problems and overcoming challenges. National Geographic images and data complete the story, opening the world of chemistry to all students.

Inspire students with stories from National Geographic Explorers who show how chemistry can solve human issues like water and air pollution, ecosystem damage, and energy production.



ENGAGE STUDENTS WITH REAL-WORLD CHEMISTRY STORIES

Chemistry 5E Lesson Design

ENGAGE

- 3D Lesson Design
- Real World Issues & Phenomena
- Driving Question
- Active Learning Lessons

EXPLORE/EXPLAIN

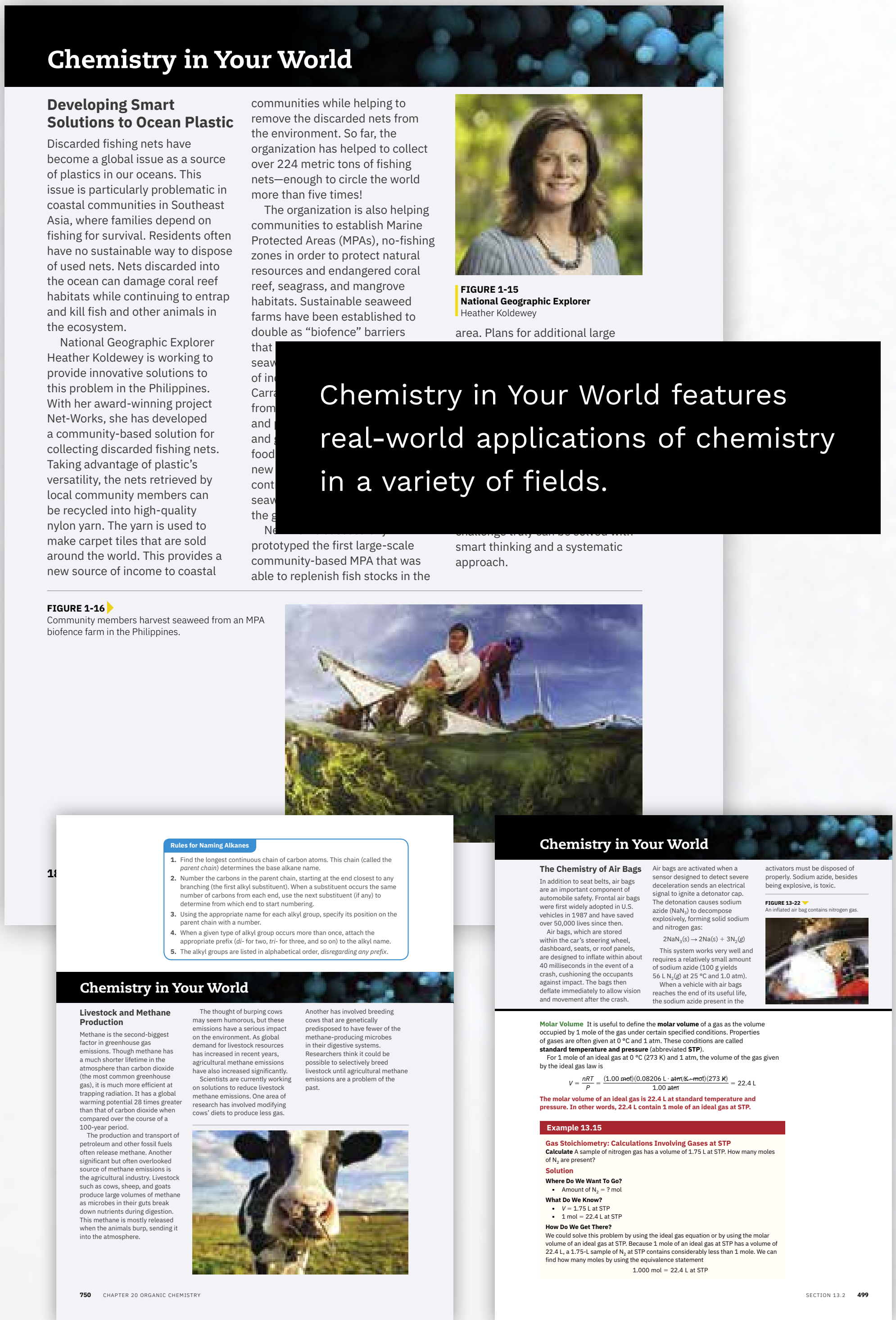
- Media Library
- Group Discussion Activities
- Simulations
- Modeling Tools
- Core Ideas & Skills Lessons
- Laboratory Experiment
- Explorers At Work
- Exploring Engineering
- Chemistry In Your World

ELABORATE

- Activity Guide
- Hands On Labs
- Laboratory Experiments
- Solving Everyday Problems
- Engineering Practices Developing Solutions
- Case Study

EVALUATE

- Lesson Checkpoints
- Formative Assessments
- Summative Assessments
- Chapter Investigations


Chemistry in Your World

Developing Smart Solutions to Ocean Plastic

Discarded fishing nets have become a global issue as a source of plastics in our oceans. This issue is particularly problematic in coastal communities in Southeast Asia, where families depend on fishing for survival. Residents often have no sustainable way to dispose of used nets. Nets discarded into the ocean can damage coral reef habitats while continuing to entrap and kill fish and other animals in the ecosystem.

National Geographic Explorer Heather Koldewey is working to provide innovative solutions to this problem in the Philippines. With her award-winning project Net-Works, she has developed a community-based solution for collecting discarded fishing nets. Taking advantage of plastic's versatility, the nets retrieved by local community members can be recycled into high-quality nylon yarn. The yarn is used to make carpet tiles that are sold around the world. This provides a new source of income to coastal communities while helping to remove the discarded nets from the environment. So far, the organization has helped to collect over 224 metric tons of fishing nets—enough to circle the world more than five times!

The organization is also helping communities to establish Marine Protected Areas (MPAs), no-fishing zones in order to protect natural resources and endangered coral reef, seagrass, and mangrove habitats. Sustainable seaweed farms have been established to double as "biofence" barriers ...

... prototyped the first large-scale community-based MPA that was able to replenish fish stocks in the area. Plans for additional large ...

... smart thinking and a systematic approach.

FIGURE 1-15 National Geographic Explorer Heather Koldewey

FIGURE 1-16 Community members harvest seaweed from an MPA biofence farm in the Philippines.

Chemistry in Your World

Livestock and Methane Production

Chemistry in Your World

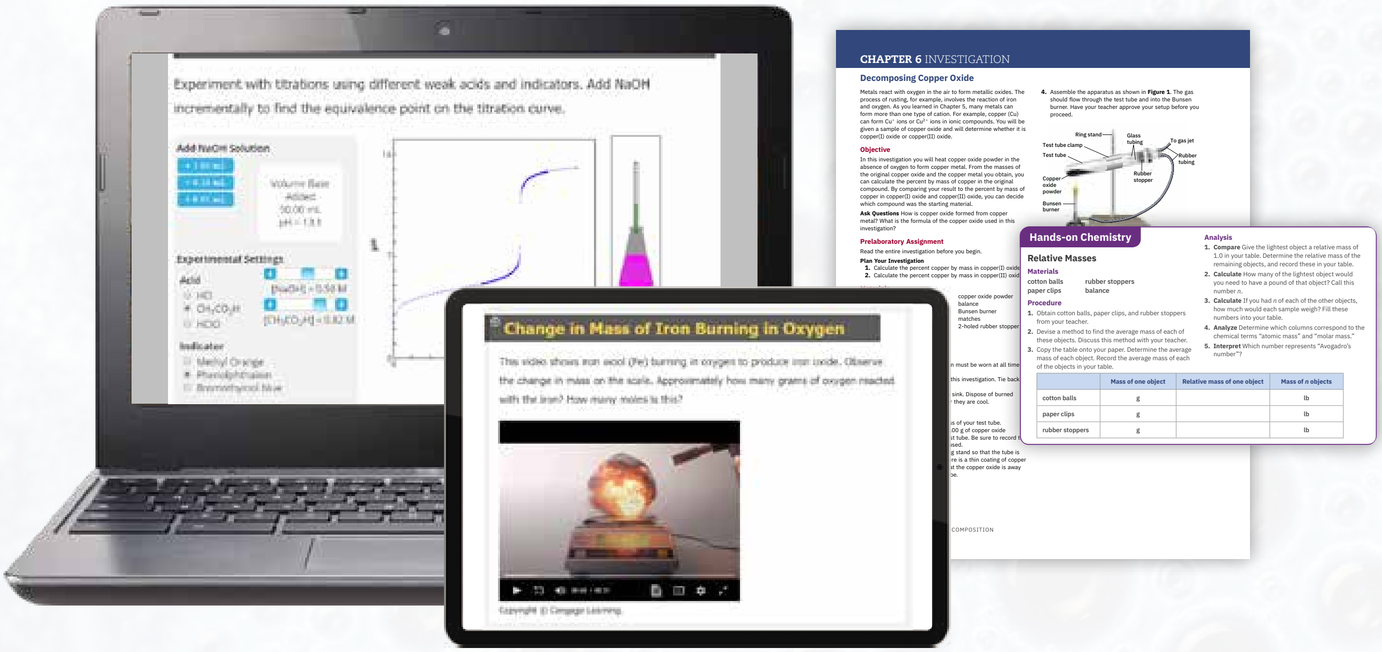
The Chemistry of Air Bags

Example 13.15

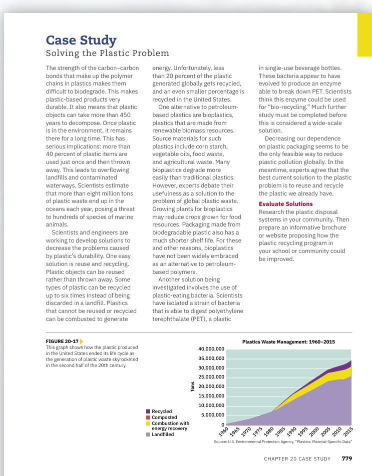
Chemistry in Your World features real-world applications of chemistry in a variety of fields.

Chemistry in Your World explores real-world applications in chemistry

TAKE STUDENTS ON A CHEMISTRY JOURNEY



Hands-on labs, investigations, projects, and digital simulations provide experiences to move students towards true understanding. Students apply 3-dimensional practices, collect and analyze data, and think creatively to solve chemistry problems.



A Case Study at the end of each chapter takes an in-depth look at a real-world issue or topic related to the chapter content. Each Case Study culminates with a student activity.

BUILD STUDENT PROBLEM-SOLVING SKILLS AND STRATEGIES

Where Do We Want To Go?

Clearly state the problem in terms of the goal or what we're trying to do.

↓

What Do We Know?

Related facts we know that provide a starting point.

↓

How Do We Get There?

The program provides tools to students for taking what we know and moving through towards the solution goal.

↓

Does It Make Sense?

Test that the solution is reasonable based on what we know.

Prepare students for college and careers by setting a foundation in *World of Chemistry* for students to think critically about chemistry and science issues and to practice strategies for solving problems inside and outside the chemistry classroom.

Guidance

A four-step problem solving approach is introduced to consistently guide students to understand what chemistry problems require to get to a solution that makes sense.

EXPLORERS AT WORK

Improving Nuclear Power

with National Geographic Explorer Leslie Dewan

We have known for nearly a century that nuclear reactions can be harnessed as a tremendous source of energy. Nuclear power plants operate similarly to traditional fossil fuel plants. The heat from a reaction is used to generate steam. The steam then powers a turbine that produces electrical power. There has been a decrease in the use of nuclear power in the United States over recent decades. This is due to the availability of relatively affordable power from natural gas, as well as societal concerns over the safety and environmental impacts of nuclear power. National Geographic Explorer Leslie Dewan is hoping to rejuvenate the nuclear industry and change society's perceptions of nuclear power.

Nearly all nuclear reactors in operation today are based on the same general process: The energy that results from nuclear reactions in solid pellets of uranium oxide is used to boil water and generate steam that powers an electrical turbine. However, some of the earliest nuclear reactor designs used uranium dissolved in molten salt. Heat from nuclear reactions in the molten salt mixture can then be used to produce steam and generate electricity. Dewan and a team of engineers have developed the design for modern molten salt reactors that would decrease waste production, improve safety, and increase the efficiency of nuclear power. In traditional reactors, the waste products of the nuclear reaction build up in the fuel elements over time. This buildup decreases the efficiency of the reaction. The metal structure that holds the uranium oxide in place is also gradually damaged as the reaction progresses. The fuel in a traditional reactor can only remain in use for about four years, after which it must be discarded.

In a molten salt reactor, the waste products of the reaction can simply be filtered out of the liquid solution. Because the uranium is suspended in a liquid instead of being held in place by metal, structural damage is minimized. This means the fuel can be used for decades, so much more of the available energy can be extracted before disposing of the uranium. The result is that far less nuclear waste is generated in the process.

Molten salt reactors are also potentially safer than traditional reactors. Traditional reactors operate at extremely high pressures. The rare catastrophic explosions that have occurred at nuclear plants are usually the result of the release of built-up pressure. The sudden release sprays nuclear waste into the surroundings. Molten salt reactors operate at atmospheric pressure, making them less likely to release waste into the environment should an accident occur.

Dewan and the team have made their research available to the public with the hope that it will inspire a new generation of nuclear engineers. "Climate change is real," she says. "Novel nuclear technologies present the best way to address the issue, by rapidly expanding carbon-free energy at scale and making fossil fuels a thing of the past."

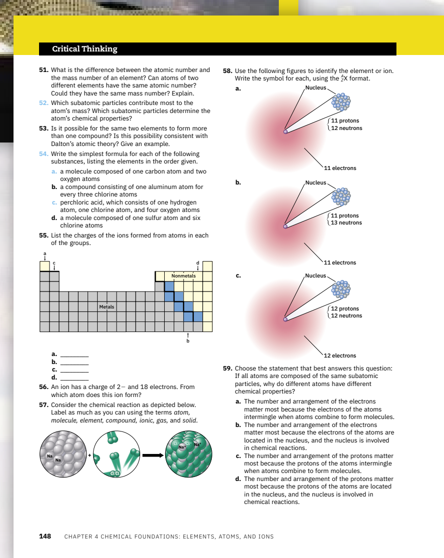
Thinking Critically
Evaluate As you read the chapter, gather evidence to explain how nuclear reactors work. How could nuclear power be used as a replacement for traditional fossil fuels? Is nuclear power a sensible large-scale solution to the world's growing power needs?

Leslie Dewan has worked to develop novel designs for safer, more efficient nuclear power plants.

An architectural rendering of a molten salt reactor illustrates the power plant's proposed design. *Inset*: A cross section shows the reactor vessel, fuel salt pumps, heat exchangers, and the steam generator inside the plant.

706 CHAPTER 19 RADIOAC

Thinking Critically
Evaluate As you read the chapter, gather evidence to explain how nuclear reactors work. How could nuclear power be used as a replacement for traditional fossil fuels? Is nuclear power a sensible large-scale solution to the world's growing power needs?



Critical Thinking

51. What is the difference between the atomic number and the mass number of an element? Can atoms of two different elements have the same atomic number? Could they have the same mass number? Explain.

52. Which subatomic particles contribute most to the atom's mass? Which subatomic particles determine the atom's chemical properties?

53. Is it possible for the same two elements to form more than one compound? Is this possibility consistent with Dalton's atomic theory? Give an example.

54. Write the simplest formula for each of the following substances, listing the elements in the order given.
- **a.** a molecule composed of one carbon atom and two oxygen atoms
- **b.** a compound consisting of one aluminum atom for every three chlorine atoms
- **c.** perchloric acid, which consists of one hydrogen atom, one chlorine atom, and four oxygen atoms
- **d.** a molecule composed of one sulfur atom and six chlorine atoms

55. List the charges of the ions formed from atoms in each of the groups.

a. ________
b. ________
c. ________
d. ________

56. An ion has a charge of 2− and 18 electrons. From which atom does this ion form?

57. Consider the chemical reaction as depicted below. Label as much as you can using the terms *atom, molecule, element, compound, ionic, gas,* and *solid.*

58. Use the following figures to identify the element or ion. Write the symbol for each, using the $^{A}_{Z}X$ format.

a.

b.

c.

59. Choose the statement that best answers this question: If all atoms are composed of the same subatomic particles, why do different atoms have different chemical properties?
- **a.** The number and arrangement of the electrons matter most because the electrons of the atoms intermingle when atoms combine to form molecules.
- **b.** The number and arrangement of the electrons matter most because the electrons of the atoms are located in the nucleus, and the nucleus is involved in chemical reactions.
- **c.** The number and arrangement of the protons matter most because the protons of the atoms intermingle when atoms combine to form molecules.
- **d.** The number and arrangement of the protons matter most because the protons of the atoms are located in the nucleus, and the nucleus is involved in chemical reactions.

148 CHAPTER 4 CHEMICAL FOUNDATIONS: ELEMENTS, ATOMS, AND IONS

Students practice deeper Depth of Knowledge with critical thinking questions throughout the program to challenge and extend learning.

Simulations

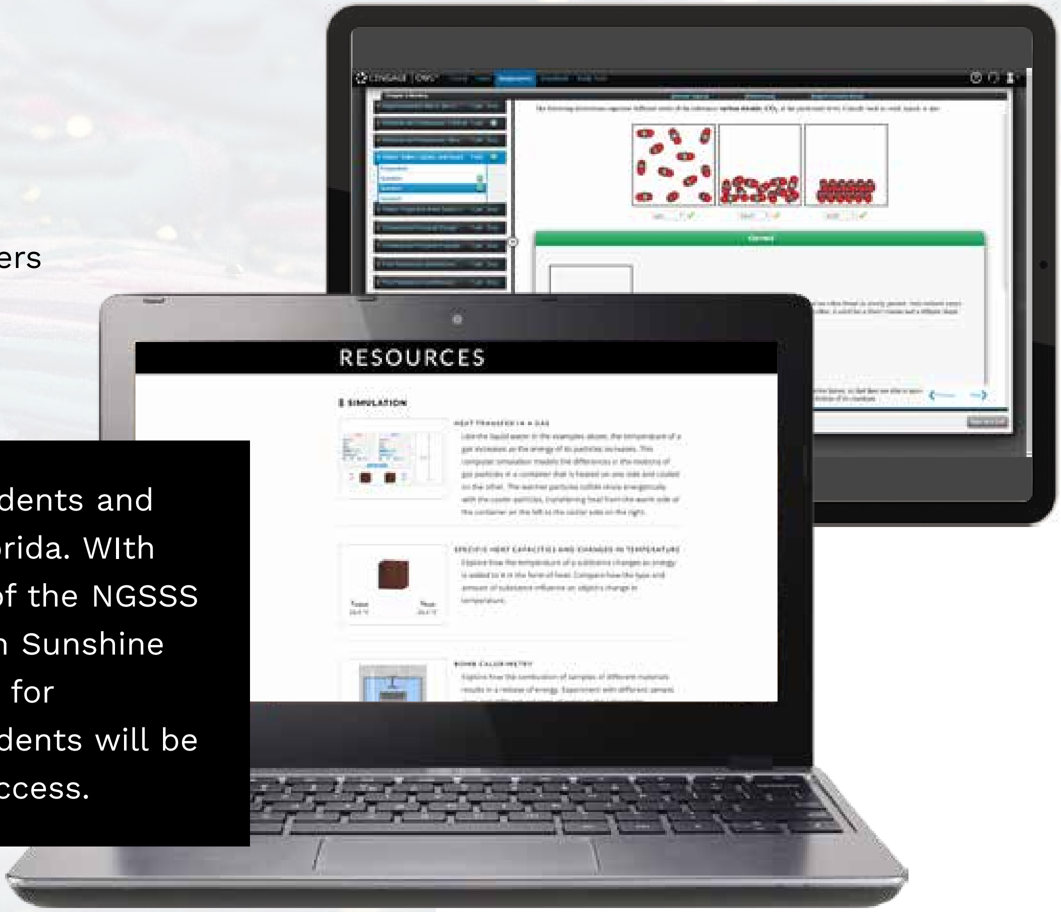
Students have a variety of ways to apply their problem-solving skills with practice problems, group discussion activities, and online practice in the MindTap platform.

APPLICATION OF HESS'S LAW

Investigate how the enthalpies of a series of reactions can be added together according to Hess's law. Determine the enthalpy for the formation of tin(II) bromide and titanium tetrachloride from tin(II) chloride and titanium(II) bromide.

Team Learning Worksheet questions are designed for students to work in groups to explain their reasoning for answers and solutions. These require discussion and a true depth of understanding to explain and provide details and examples to support claims.

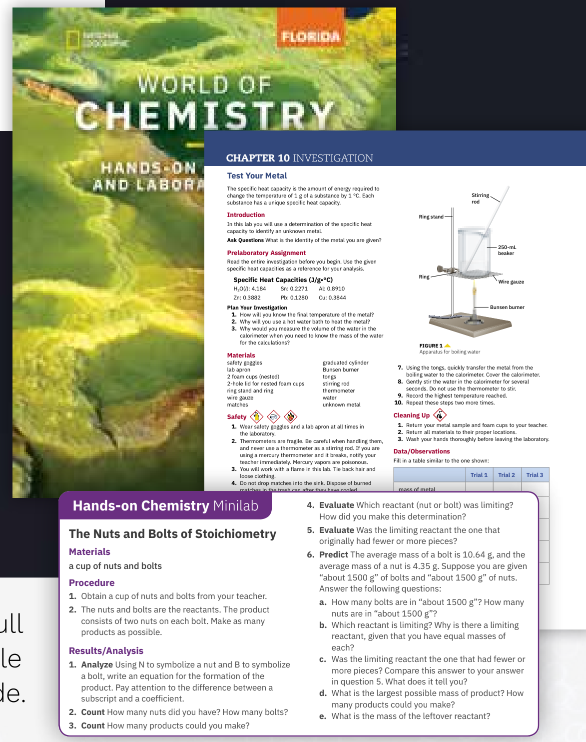
The eBook content is enhanced with embedded videos, simulations, and 3D molecular model viewers as well as highlighting and note-taking tools.



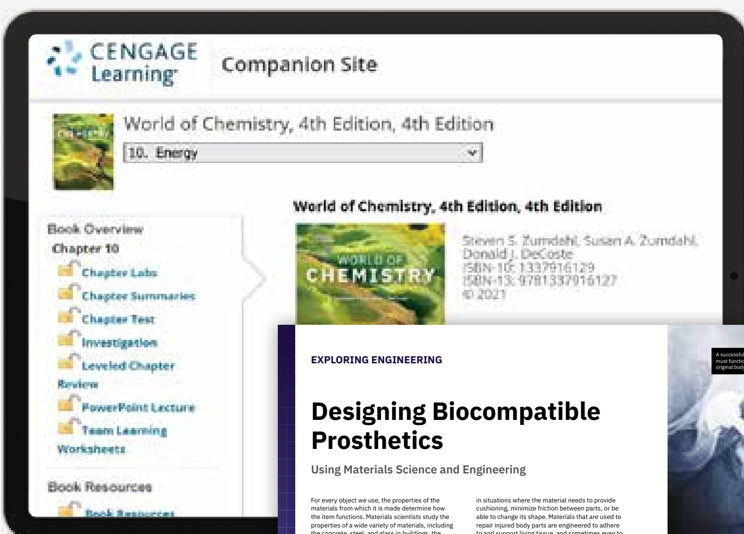
Built for the students and educators of Florida. WIth 100% coverage of the NGSSS (Next Generation Sunshine State Standards for Science), all students will be equipped for success.

HANDS-ON CHEMISTRY AND ENGINEERING PROJECTS

Shifts in science teaching mean more active student learning through Science and Engineering Practices. *World of Chemistry* offers a wide range of activities, labs, projects, and investigations to keep students applying chemistry knowledge and building hands-on problem-solving skills.



Student materials include chapter Minilabs, a full Investigation lab for each chapter, and four large scale engineering projects in the Activity Guide.

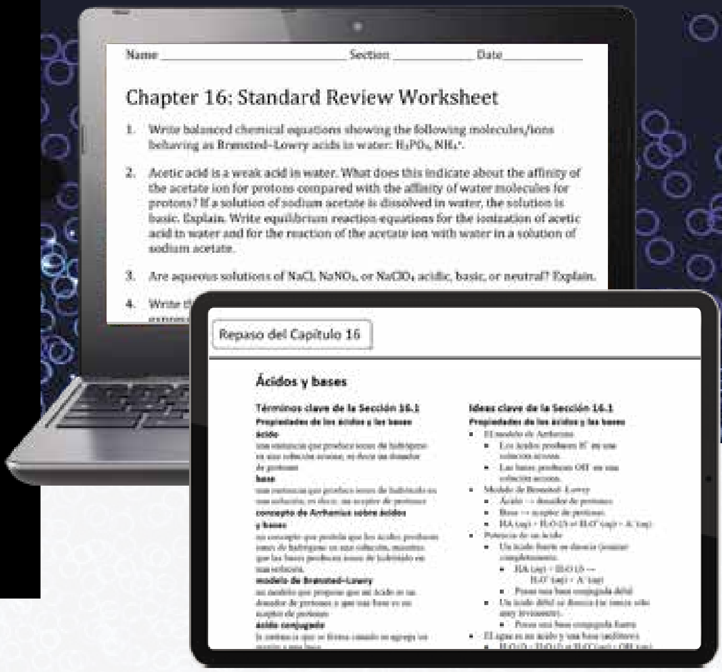


Additional hands-on labs and projects are available for download from the teacher **Companion Site** including Chapter Labs, Classroom Activities and Projects, and the Team Learning Worksheet activities.

The work of Engineers is highlighted in "Exploring Engineering" articles at the beginning of some chapters and in "Chemical Engineering" features throughout the program. Engineering Practices are detailed in Chapter 1 and are applied by students in labs and Investigations.

CONNECT ALL STUDENTS IN QUALITY LEARNING

Students will enter chemistry classes with a wide variety of skills and experience, the need for teacher support to meet these needs is critical. *World of Chemistry* includes everything teachers need to ensure all students can access materials, activities, and digital resources for mastering chemistry.



MEETING INDIVIDUAL NEEDS
Reading Concepts

It may have been some time since students dealt with chemical equations. For a review, have stude read the *Reading Chemical Equatio* resource located on the Instructor Companion Website.

DIFFERENTIATED INSTRUCTION
Leveled Support

Advanced Learners
In this section, students learn that entropy is a measure of the dispersal of energy. Have advanced students explore the concept that the natural tendency of the universe is for energy to become more spread out by having them do research to find real world implications of the second law of thermodynamics.

Struggling Students
If students have difficulty understanding the concept of entropy, show them Figure 10-26. Emphasize that steam has less order and therefore a higher value of entropy than ice. Then have them look at Figure 2-10 in **Chapter 2**. Point out the diagrams for ice and water. Ask them which seems to have less order and therefore a higher value of entropy.

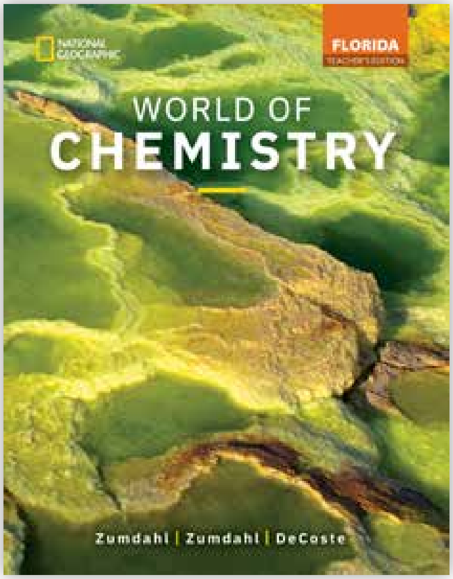
DIFFERENTIATED INSTRUCTION
English Language Learners

Use Academic Language Some phrases in this section may sound unusual to students or may be difficult to translate if the literal meanings of the words are used. Ask students what they think the literal translations of "giving up an electron" and "lose an electron" are. Then explain that both phrases refer to the release of an electron from an atom, often during a chemical reaction. Also ask students to describe the literal meaning of "chemically active," and then explain that it refers to an element that has a structure that enables it to readily participate in a chemical reaction. To check students' understanding, have them write sentences using all three phrases correctly.

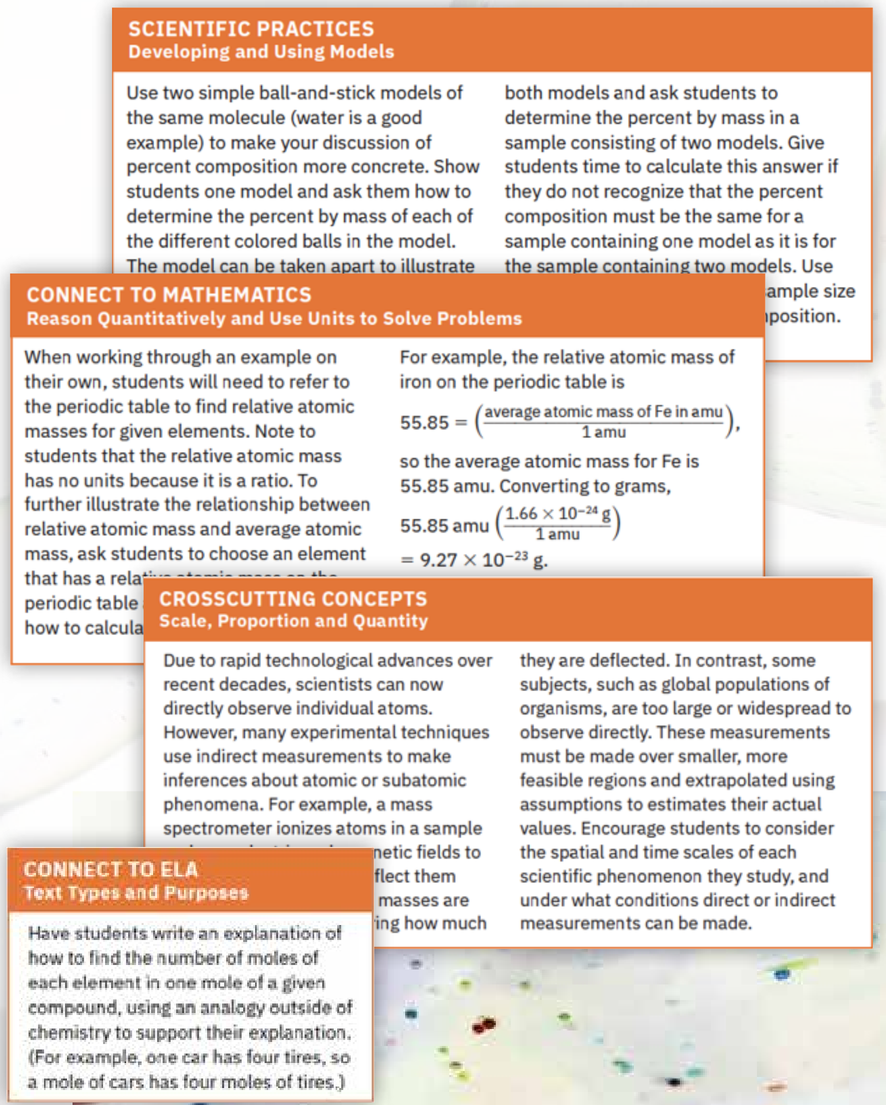
Support diverse learners with Differentiated Instruction boxes to provide leveled support for Struggling Students, Advanced Learners, and English Learners. Meeting Individual Needs notes provide strategies for addressing math concepts and reading skills in the context of chemistry.

COURSE SUPPORT AND TEACHING TOOLS

Additional downloadable resources include lecture slides, chapter tests, student practice pages, chapter summaries in English and Spanish, and the Cognero customizable test generator.



The wraparound Teacher's Edition includes Chapter Planning Guides summarizing chapter resources including support for differentiation, hands-on lessons, interdisciplinary and career connections, MindTap online learning resources.



SCIENTIFIC PRACTICES
Developing and Using Models

Use two simple ball-and-stick models of the same molecule (water is a good example) to make your discussion of percent composition more concrete. Show students one model and ask them how to determine the percent by mass of each of the different colored balls in the model. The model can be taken apart to illustrate both models and ask students to determine the percent by mass in a sample consisting of two models. Give students time to calculate this answer if they do not recognize that the percent composition must be the same for a sample containing one model as it is for the sample containing two models. Use ...ample size ...position.

CONNECT TO MATHEMATICS
Reason Quantitatively and Use Units to Solve Problems

When working through an example on their own, students will need to refer to the periodic table to find relative atomic masses for given elements. Note to students that the relative atomic mass has no units because it is a ratio. To further illustrate the relationship between relative atomic mass and average atomic mass, ask students to choose an element that has a rela... periodic table ... how to calcula...

For example, the relative atomic mass of iron on the periodic table is

$$55.85 = \left(\frac{\text{average atomic mass of Fe in amu}}{1\ \text{amu}}\right),$$

so the average atomic mass for Fe is 55.85 amu. Converting to grams,

$$55.85\ \text{amu}\left(\frac{1.66 \times 10^{-24}\ \text{g}}{1\ \text{amu}}\right)$$
$$= 9.27 \times 10^{-23}\ \text{g}.$$

CROSSCUTTING CONCEPTS
Scale, Proportion and Quantity

Due to rapid technological advances over recent decades, scientists can now directly observe individual atoms. However, many experimental techniques use indirect measurements to make inferences about atomic or subatomic phenomena. For example, a mass spectrometer ionizes atoms in a sample ...netic fields to ...flect them ...masses are ...ing how much they are deflected. In contrast, some subjects, such as global populations of organisms, are too large or widespread to observe directly. These measurements must be made over smaller, more feasible regions and extrapolated using assumptions to estimates their actual values. Encourage students to consider the spatial and time scales of each scientific phenomenon they study, and under what conditions direct or indirect measurements can be made.

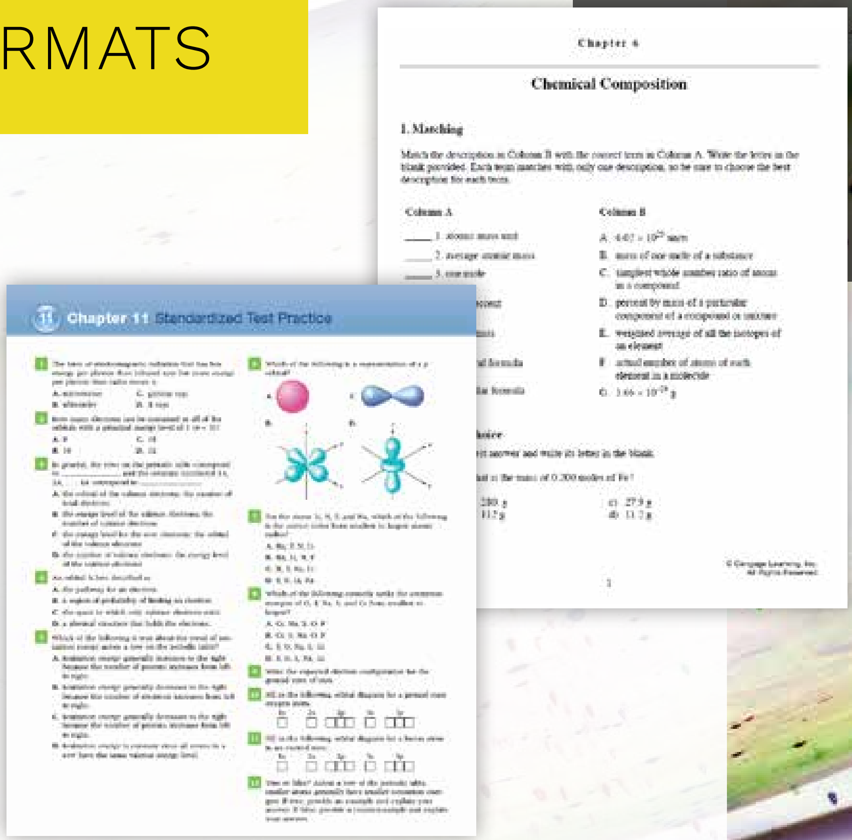
CONNECT TO ELA
Text Types and Purposes

Have students write an explanation of how to find the number of moles of each element in one mole of a given compound, using an analogy outside of chemistry to support their explanation. (For example, one car has four tires, so a mole of cars has four moles of tires.)

Crosscutting Concepts Boxes help teachers deepen students' understanding and connect with prior learning. Each **Scientific Practices** or **Engineering Practices** box supports the use of the chemistry content to engage students in these practices. **Connect to ELA** features provide strategies for addressing Florida's B.E.S.T. Standards for Math and ELA.

ASSESSMENTS IN A VARIETY OF FORMATS

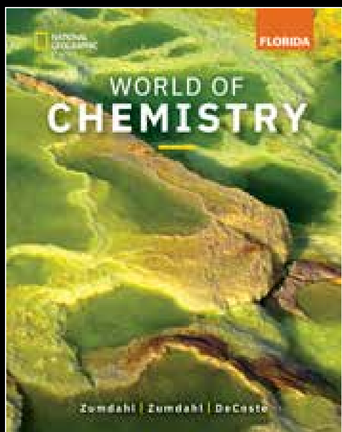
In addition to "checkpoint" questions throughout the student book and chapter review questions, a variety of supplementary assessment materials allow teachers to customize the approach to ensuring student success. Each chapter includes a Standardized Test Practice assessment, a comprehensive Chapter Test, and supplementary student worksheets and activities.



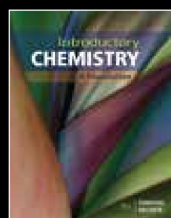
Cognero Test Bank is a flexible, online system that allows you to author, edit, and manage test content.

cognero® Full-Circle Assessment®

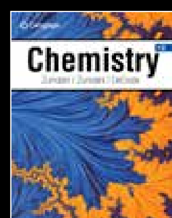
The cornerstone of our chemistry solution is renown authors Steven and Susan Zumdahl. The Zumdahl's and their writing partners use a thoughtful approach built on creative problem-solving techniques and critical thinking.



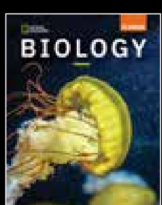
World of Chemistry, Florida Edition is part of our chemistry series to meet the needs of on-level, honors, and AP® Chemistry. Help students become expert problem-solvers and to think like chemists with our high school chemistry solutions.

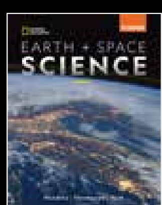


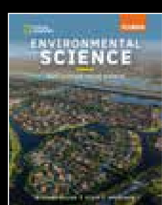
Honors



AP®







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