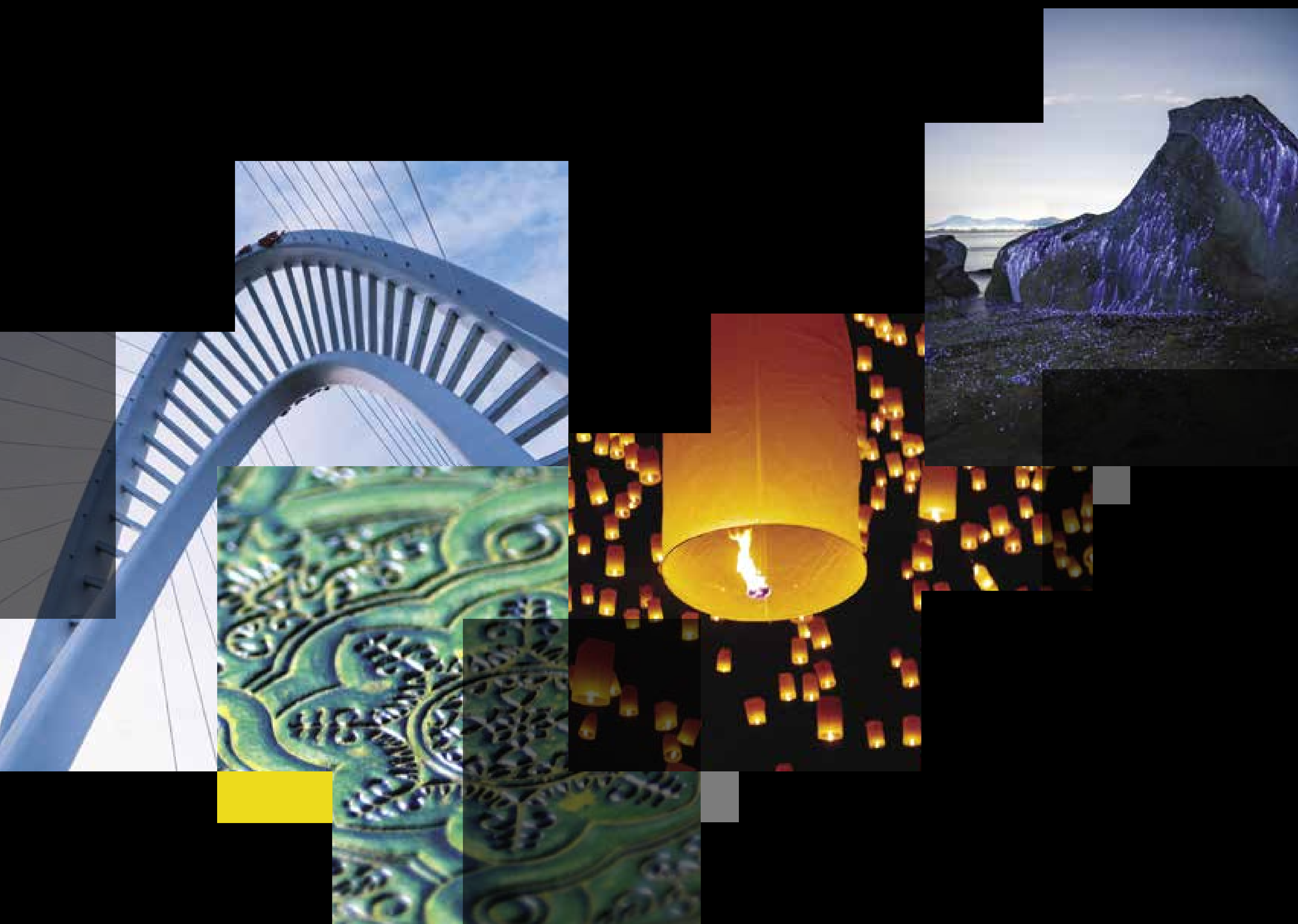
NATIONAL GEOGRAPHIC

Texas Grades 9-12

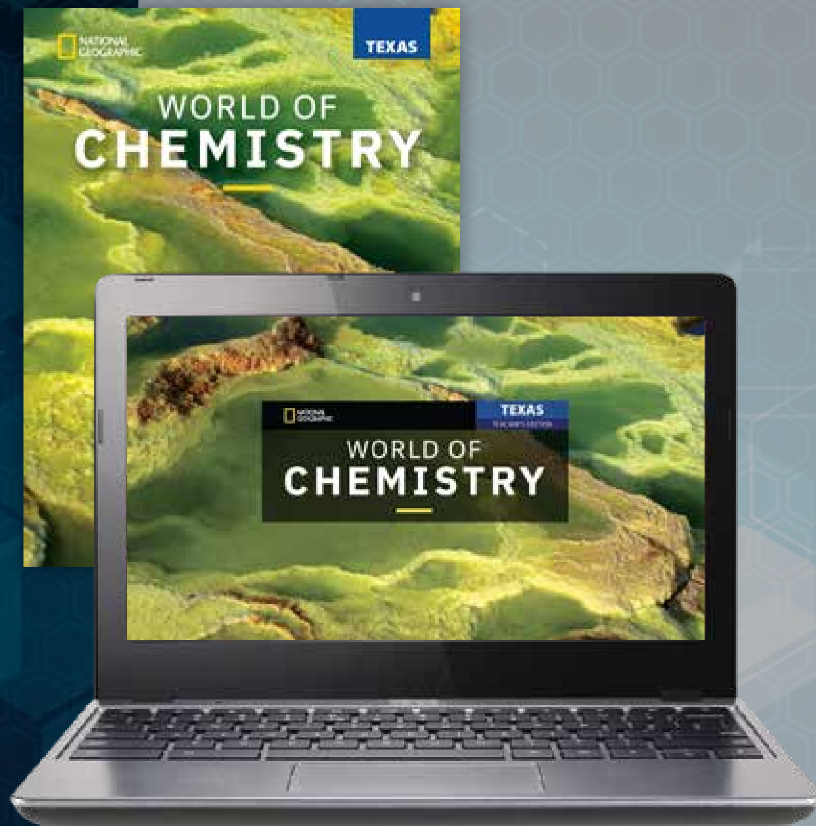
WORLD OF CHEMISTRY

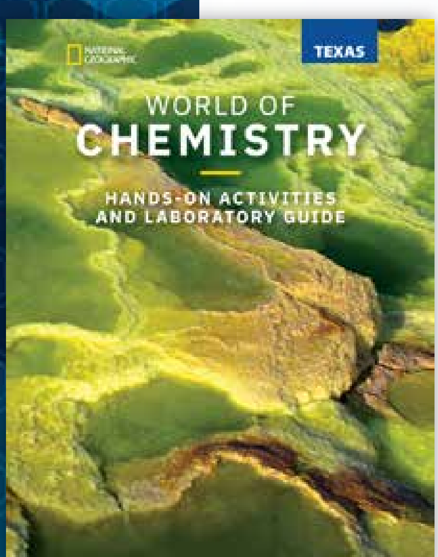
Texas Edition



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?”

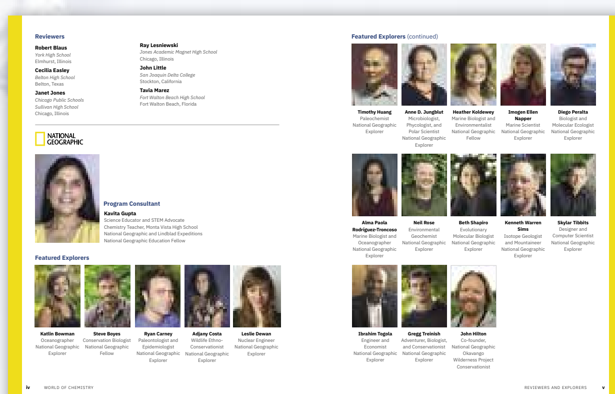
Students will think like chemists to create real-world solutions for projects in the *World Of Chemistry, Texas Edition* **Activity Guide**. **Team Learning** activities inspire group discussions to help students get to the deeper meaning and importance of chemistry concepts.

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

Authentic National Geographic Experiences

World of Chemistry, Texas Edition makes chemistry real for students through the stories of renown 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

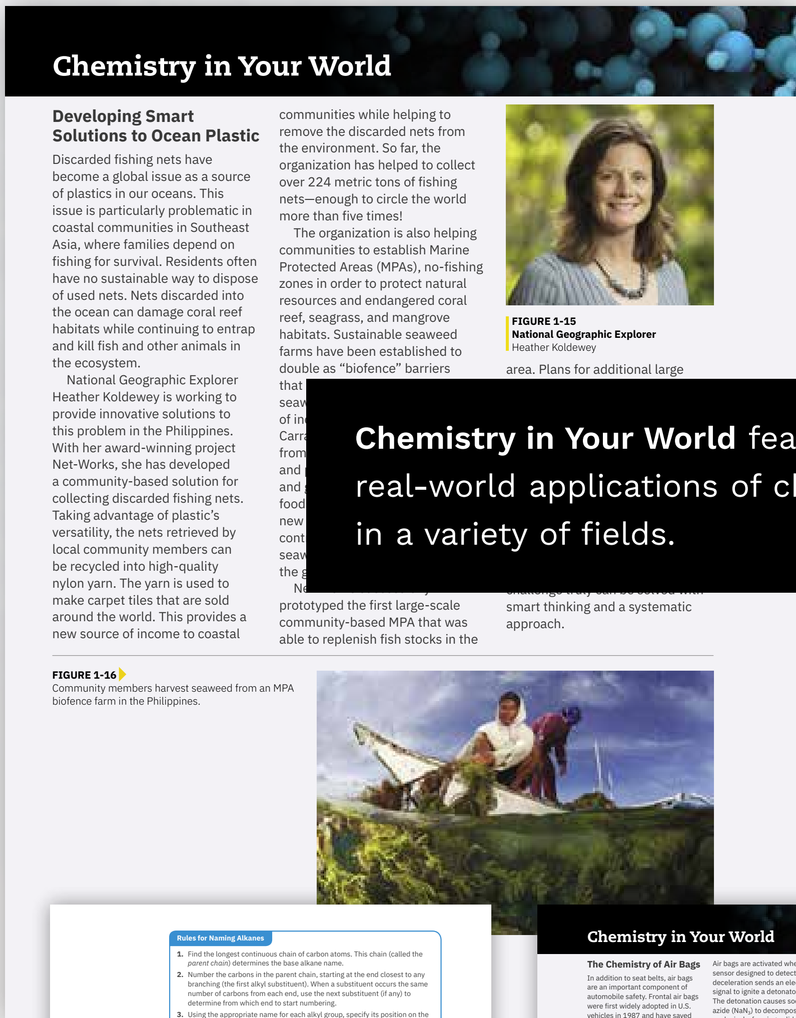
- Media Library
- Group Discussion Activities
- Simulations
- Modeling Tools
- Core Ideas & Skills Lessons
- Laboratory Experiment
- Explorers At Work
- Exploring Engineering
- Chemistry In Your World

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 that …

… prototyped the first large-scale community-based MPA that was able to replenish fish stocks in the …

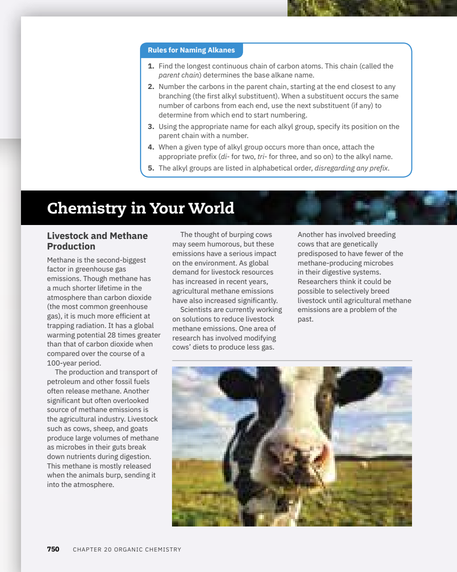
FIGURE 1-15
National Geographic Explorer
Heather Koldewey

area. Plans for additional large …

… smart thinking and a systematic approach.

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

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



Rules for Naming Alkanes

1. Find the longest continuous chain of carbon atoms. This chain (called the *parent chain*) determines the base alkane name.
2. Number the carbons in the parent chain, starting at the end closest to any branching (the first alkyl substituent). When a substituent occurs the same number of carbons from each end, use the next substituent (if any) to determine from which end to start numbering.
3. Using the appropriate name for each alkyl group, specify its position on the parent chain with a number.
4. When a given type of alkyl group occurs more than once, attach the appropriate prefix (*di-* for two, *tri-* for three, and so on) to the alkyl name.
5. The alkyl groups are listed in alphabetical order, *disregarding any prefix*.

Chemistry in Your World

Livestock and Methane Production

Methane is the second-biggest factor in greenhouse gas emissions. Though methane has a much shorter lifetime in the atmosphere than carbon dioxide (the most common greenhouse gas), it is much more efficient at trapping radiation. It has a global warming potential 28 times greater than that of carbon dioxide when compared over the course of a 100-year period.

The production and transport of petroleum and other fossil fuels often release methane. Another significant but often overlooked source of methane emissions is the agricultural industry. Livestock such as cows, sheep, and goats produce large volumes of methane as microbes in their guts break down nutrients during digestion. This methane is mostly released when the animals burp, sending it into the atmosphere.

The thought of burping cows may seem humorous, but these emissions have a serious impact on the environment. As global demand for livestock resources has increased in recent years, agricultural methane emissions have also increased significantly.

Scientists are currently working on solutions to reduce livestock methane emissions. One area of research has involved modifying cows' diets to produce less gas. Another has involved breeding cows that are genetically predisposed to have fewer of the methane-producing microbes in their digestive systems. Researchers think it could be possible to selectively breed livestock until agricultural methane emissions are a problem of the past.

750 CHAPTER 20 ORGANIC CHEMISTRY

Chemistry in Your World

The Chemistry of Air Bags

In addition to seat belts, air bags are an important component of automobile safety. Frontal air bags were first widely adopted in U.S. vehicles in 1987 and have saved over 50,000 lives since then.

Air bags, which are stored within the car's steering wheel, dashboard, seats, or roof panels, are designed to inflate within about 40 milliseconds in the event of a crash, cushioning the occupants against impact. The bags then deflate immediately to allow vision and movement after the crash.

Air bags are activated when a sensor designed to detect severe deceleration sends an electrical signal to ignite a detonator cap. The detonation causes sodium azide (NaN_3) to decompose explosively, forming solid sodium and nitrogen gas:

$$2NaN_3(s) \rightarrow 2Na(s) + 3N_2(g)$$

This system works very well and requires a relatively small amount of sodium azide (100 g yields 56 L $N_2(g)$ at 25 °C and 1.0 atm).

When a vehicle with air bags reaches the end of its useful life, the sodium azide present in the activators must be disposed of properly. Sodium azide, besides being explosive, is toxic.

FIGURE 13-22
An inflated air bag contains nitrogen gas.

Molar Volume It is useful to define the **molar volume** of a gas as the volume occupied by 1 mole of the gas under certain specified conditions. Properties of gases are often given at 0 °C and 1 atm. These conditions are called **standard temperature and pressure** (abbreviated **STP**).

For 1 mole of an ideal gas at 0 °C (273 K) and 1 atm, the volume of the gas given by the ideal gas law is

$$V = \frac{nRT}{P} = \frac{(1.00\ \text{mol})(0.08206\ \text{L}\cdot\text{atm/K}\cdot\text{mol})(273\ \text{K})}{1.00\ \text{atm}} = 22.4\ \text{L}$$

The molar volume of an ideal gas is 22.4 L at standard temperature and pressure. In other words, 22.4 L contain 1 mole of an ideal gas at STP.

Example 13.15

Gas Stoichiometry: Calculations Involving Gases at STP

Calculate A sample of nitrogen gas has a volume of 1.75 L at STP. How many moles of N_2 are present?

Solution

Where Do We Want To Go?

- Amount of N_2 = ? mol

What Do We Know?

- V = 1.75 L at STP
- 1 mol = 22.4 L at STP

How Do We Get There?

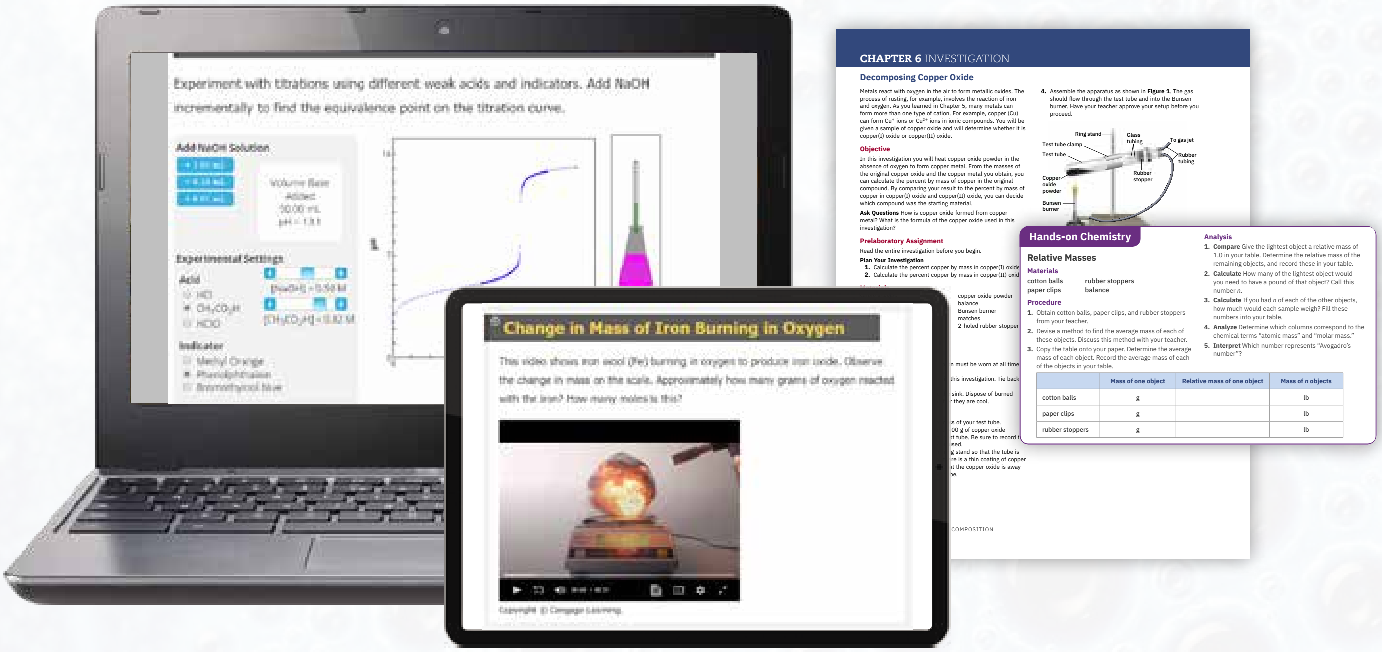
We could solve this problem by using the ideal gas equation or by using the molar volume of an ideal gas at STP. Because 1 mole of an ideal gas at STP has a volume of 22.4 L, a 1.75-L sample of N_2 at STP contains considerably less than 1 mole. We can find how many moles by using the equivalence statement

$$1.000\ \text{mol} = 22.4\ \text{L at STP}$$

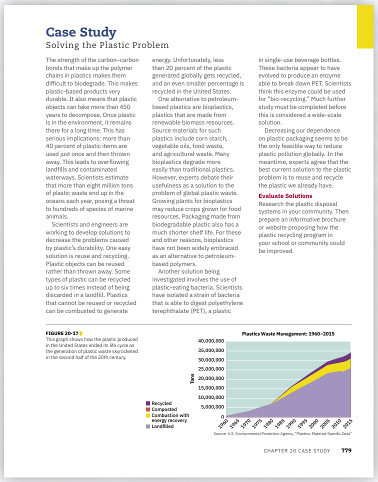
SECTION 13.2 499

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, Texas Edition* for students to think critically about chemistry and science issues and to practice strategies for solving problems inside and outside the chemistry classroom.

Guidance

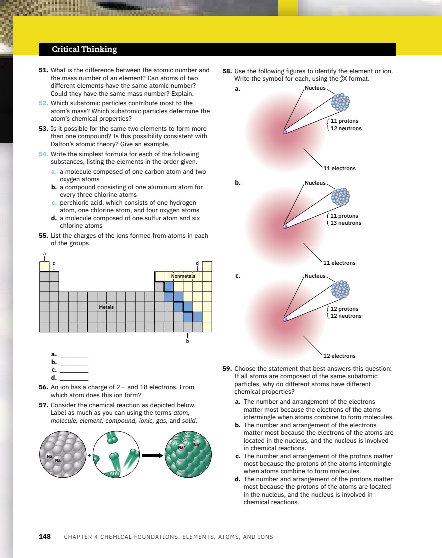
A four-step problem solving approach is introduced to consistently guide students to understand what chemistry problems require to get to a solution that makes sense.


EXPLORERS AT WORK

Improving Nuclear Power

with National Geographic Explorer Leslie Dewan

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

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

Students practice critical thinking skills with questions throughout the program to challenge and extend learning.

Simulations

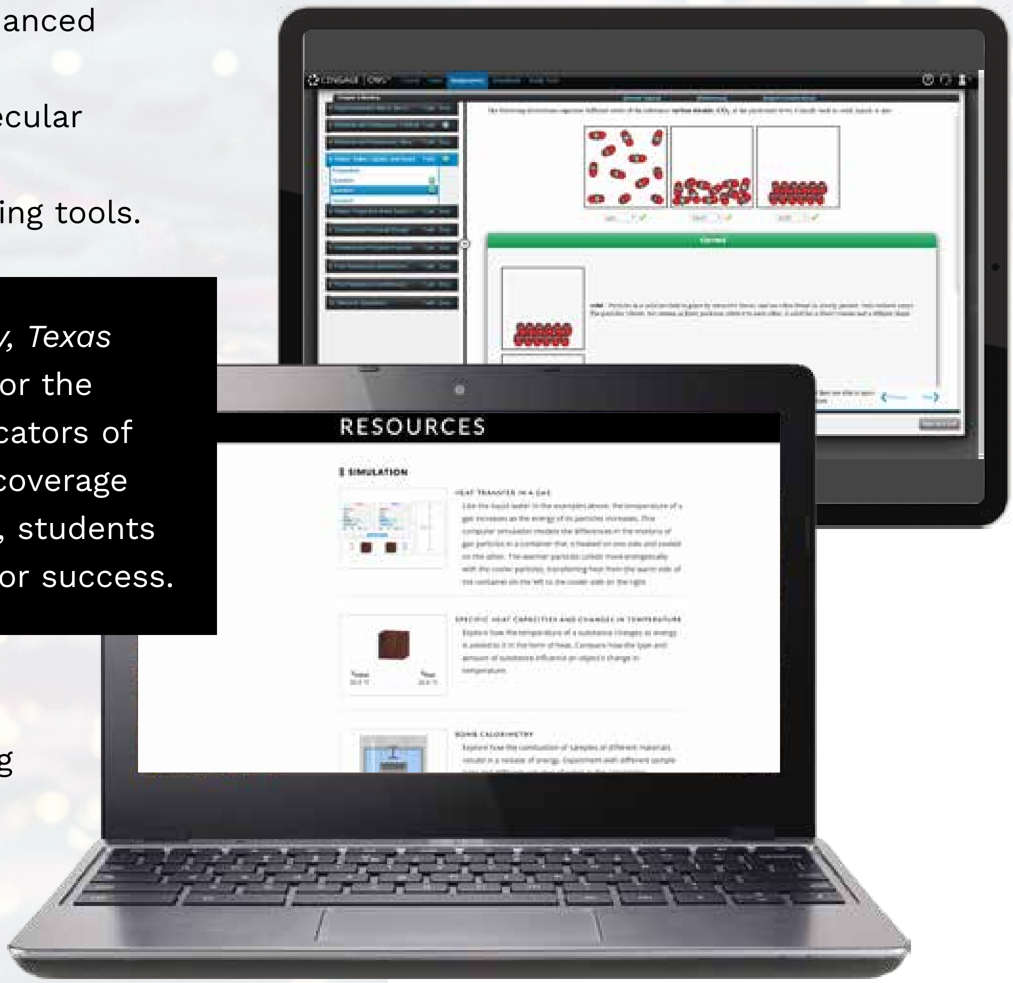
Students have a variety of ways to apply their problem-solving skills with practice problems, group discussion activities, and online practice in the MindTap platform.

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.

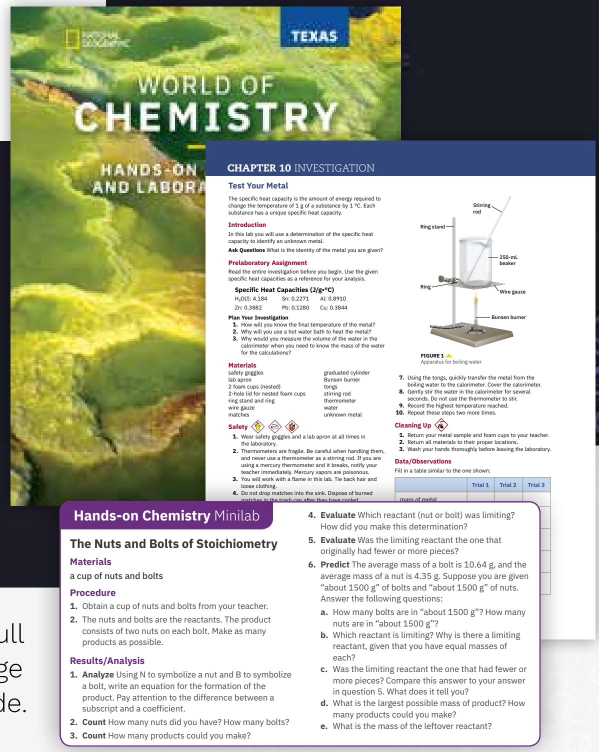


World of Chemistry, Texas Edition was built for the students and educators of Texas. With 100% coverage of TEKS and ELPS, students will be equipped for success.

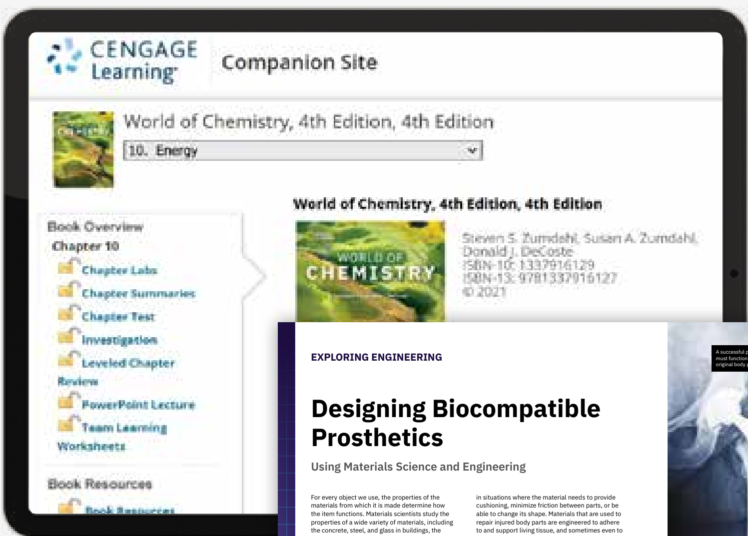
Students are able to check their understanding and reflect on their learning with practice problems and selected review questions.

HANDS-ON CHEMISTRY AND ENGINEERING PROJECTS

Shifts in science teaching mean more active student learning through Scientific and Engineering Practices. *World of Chemistry, Texas Edition* 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.

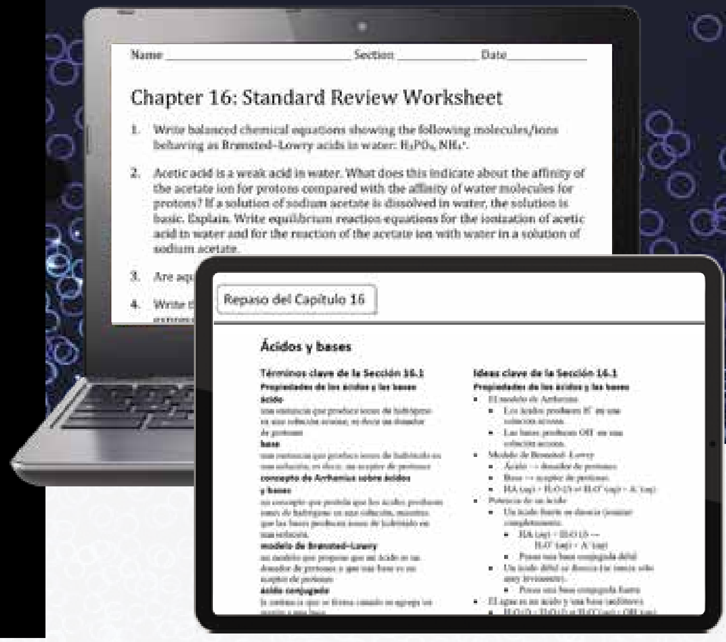


Additional hands-on labs and projects are available for download from the teacher **Companion Site** including Chapter Labs, Classroom Activities and Projects, and Team Learning Worksheet activities.

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, Texas Edition* includes everything teachers need to ensure all students can access materials, activities, and digital resources for mastering the Chemistry TEKS.



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 ...hem do ...nplications of ...amics.

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 phra... the release of an electron fr... 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

ENLGISH LANGUAGE LEARNERS | ELPS 3B, 3C, 4F

Using Visuals After students read about distillation and filtration, have them explain the separation of mixtures in Figures 2-21 and 2-23. Encourage students to use vocabulary they learned from the text. Provide students with sequence words they can use to clarify the order of the steps, such as *first, next, then, last.*

Beginning Have students take turns sharing a step in small groups. Have students begin each step with a sequence word and use vocabulary from the labels and captions in the figures.

Intermediate Have pairs take turns sharing a step in order. Encourage students to describe parts of the mixture and tools used in filtration or distillation.

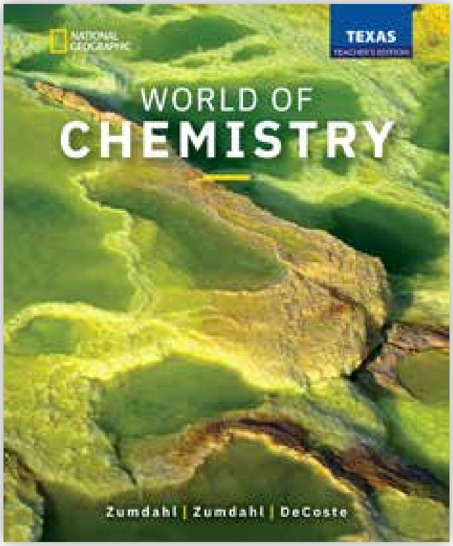
Advanced/Advanced High Have pairs explain what is happening in each figure, using as much detail as they can, based on the text they have read.

Go online to access Acquire English 2.C.

Support all students with Differentiated Instruction boxes to provide leveled support for Striving 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 the first step—that is, to determine the mass of all balls of the same color. After a discussion about percentages, display 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 this discussion to explain that sample size does not influence percent composition.

Recurring Theme and 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 the TEKS for Math and ELA.

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 relative atomic mass on the periodic table and show, using units, how to calculate the mass in grams.

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,

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

$$= 9.27 \times 10^{-23}\ \text{g}.$$

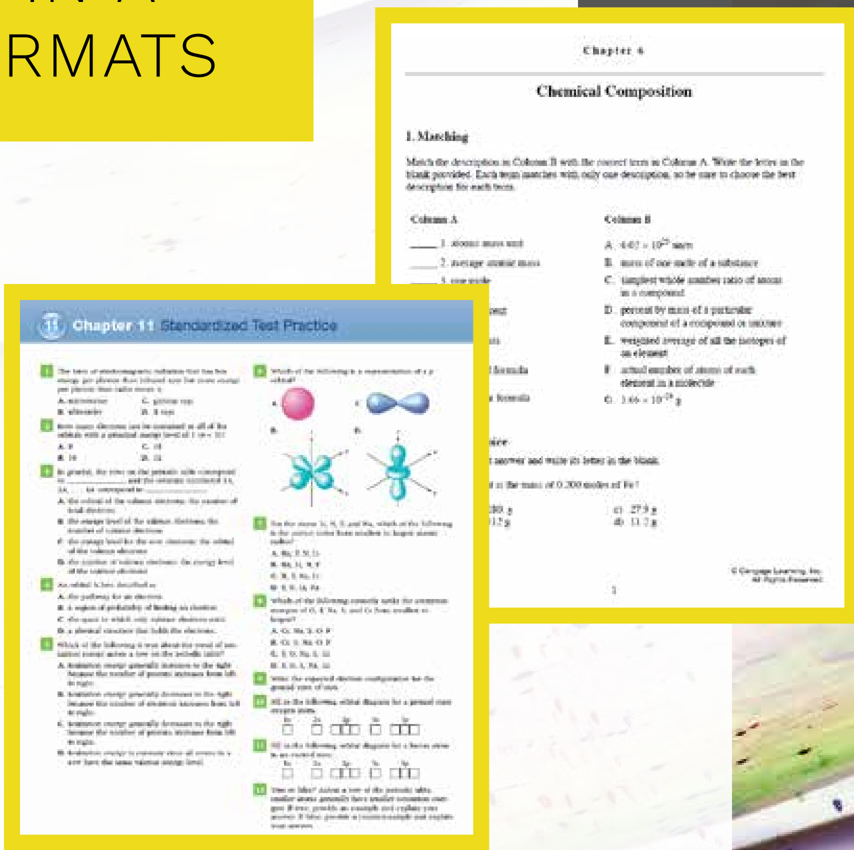
Ask students how they would find the mass of one mole of Fe atoms, and have them perform this operation.

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.)

ASSESSMENTS IN A VARIETY OF FORMATS

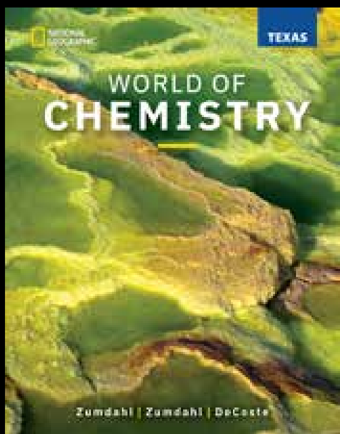
In addition to "checkpoint" questions throughout the student book and chapter review questions, a variety of supplementary assessment materials allow teachers to customize the approach to ensuring student success. Each chapter includes a **Standardized Test Practice** assessment, a comprehensive **Chapter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



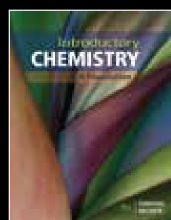
Cognero Test Bank
is a flexible, online system that allows you to author, edit, and manage test content.

cognero® Full-Circle Assessment®

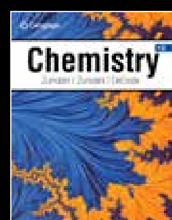
The cornerstone of our chemistry solution is renown authors Steven and Susan Zumdahl. The Zumdahls and their writing partners use a thoughtful approach built on creative problem-solving techniques and critical thinking.



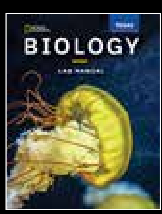
World of Chemistry, Texas Edition is part of our chemistry series to meet the needs of on-level, honors, and AP® Chemistry. Help students become expert problem-solvers and to think like chemists with our high school chemistry solutions.

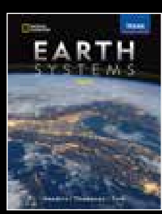


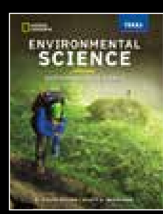
Honors



AP®







*Let **National Geographic** engage all of your learners. Explore our other high school solutions, and bring the world to your classroom.*

For more information, visit
NGL.Cengage.com/TX-Science

@NatGeoLearning @ExploreInside @NatGeoLearning

NATIONAL GEOGRAPHIC LEARNING | Cengage

ISBN-13: 979-8-214-08326-1
90000
9 798214 083261
APRIL / 2023