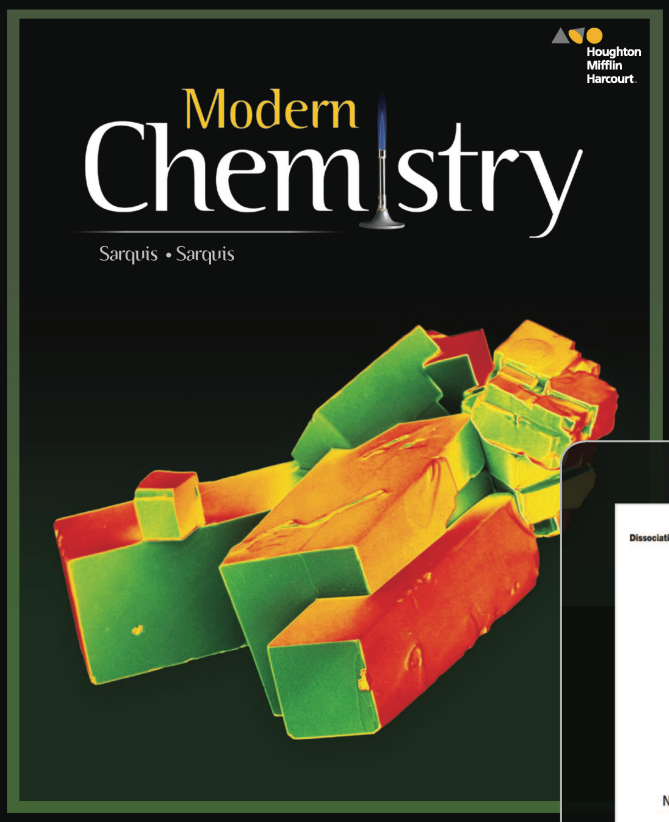
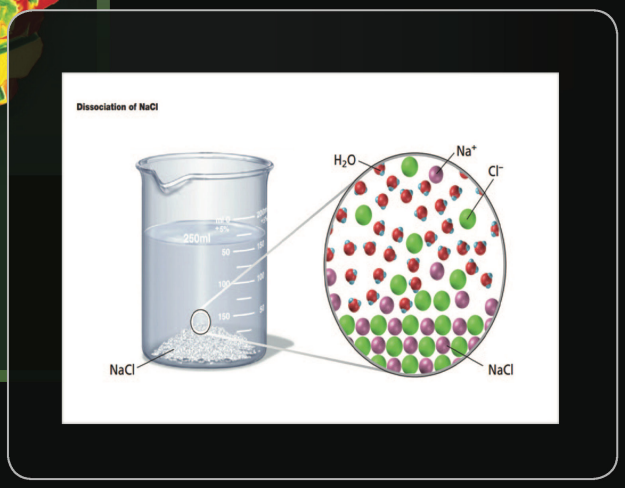
Houghton Mifflin Harcourt

Modern Chemistry



Featuring connections to THING EXPLAINER & Google Expeditions



“Education is the most powerful tool which you can use to change the world.”

— Nelson Mandela

HMH *Modern Chemistry*® empowers teachers to deliver effective, engaging, and motivating instruction with an abundance of print and digital resources, including rich multimedia, animations and simulations.

Try it now!

1	Go to:	preview.hrw.com
2	Enter Sample Word:	HSNASC17
3	Enter your registration information, select “Register” and follow the on-screen instructions to receive your credentials and get started	

Everything you need—now in one convenient online location!

The Interactive Online Edition gives students and teachers 24/7 point-of-use access to all program components.

Why it Matters

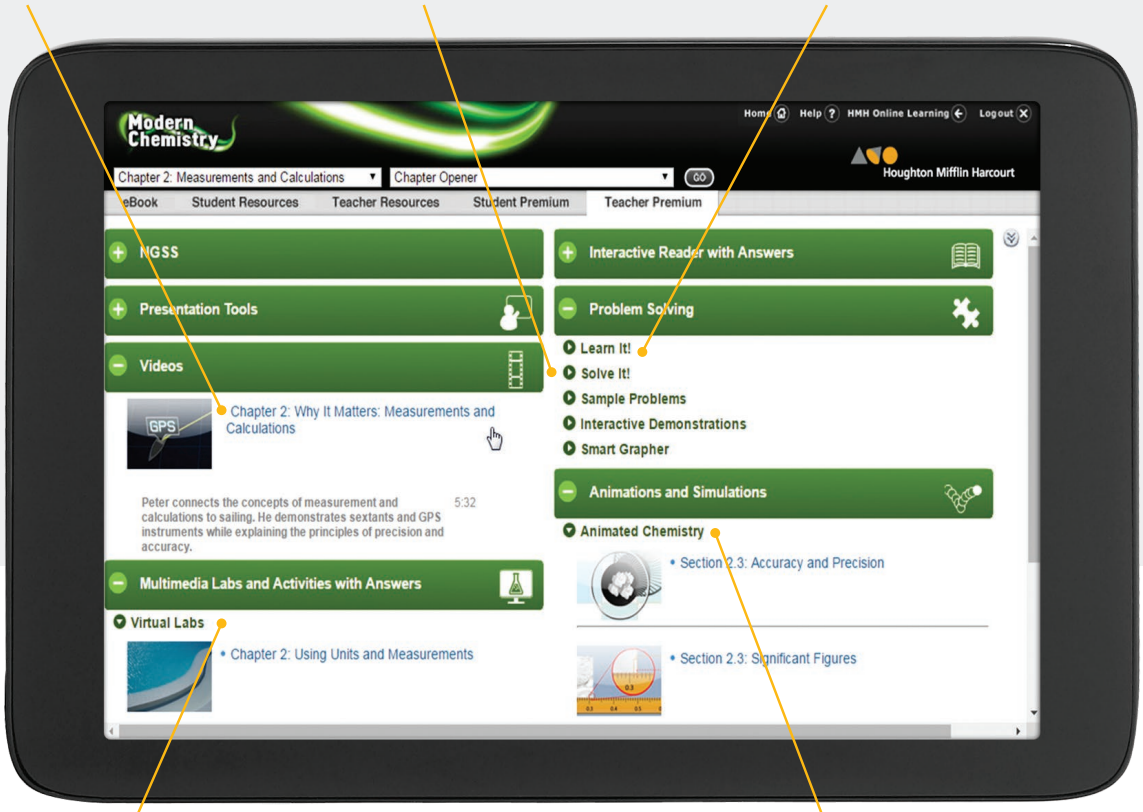
Each chapter opens with a dynamic video that relates the content to everyday life.

Solve It! Cards

Portable reference cards offer quick access to strategies for solving almost any chemistry problem.

Learn It! Videos

Tutorial videos walk students through challenging problems and offer tips for success.

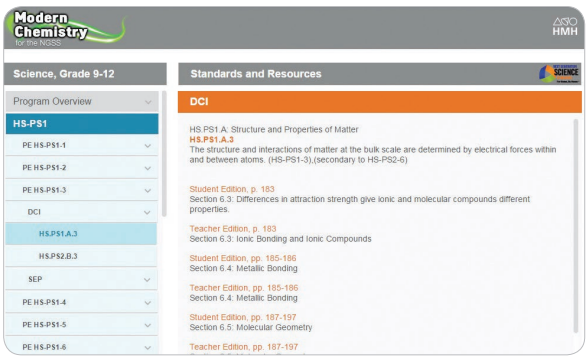


Virtual Labs

Students can conduct meaningful experiments in a simulated lab or field setting without the expense, time, or risk of traditional lab settings.

Animated Chemistry

Animations and simulations help students visualize and comprehend complex concepts.



NGSS* Correlations

Correlations both online and in the TE facilitate standards implementation.

NEXT GENERATION SCIENCE STANDARDS

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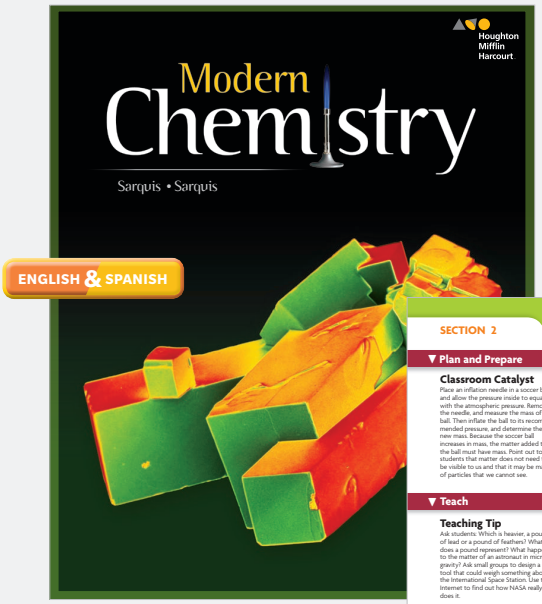
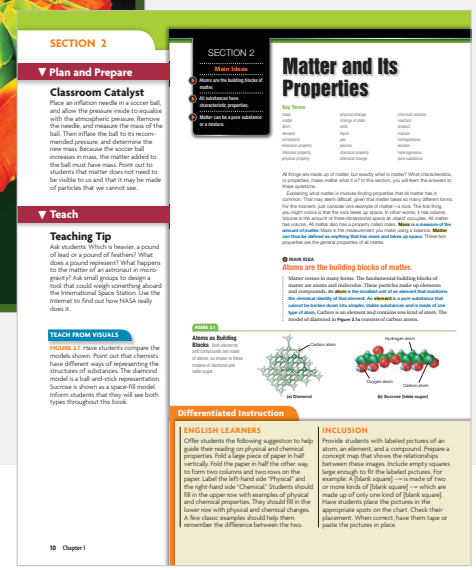
Print components **designed** and **aligned** for easy access

HMH *Modern Chemistry* enables you to reach all learners by providing time-saving, easy-to-use resources to help students of all abilities achieve understanding and success.



Student Edition

Offers features that make chemistry concepts more accessible, such as **highlighted vocabulary, problem-solving support,** and references to online student support tools.



Teacher Edition

Packed with a wide variety of **strategies** to help all students master chemistry concepts, plus **extended learning** opportunities for advanced students.

Dr. Jerry Sarquis, Professor *Emeritus*, Chemistry Education, Miami University

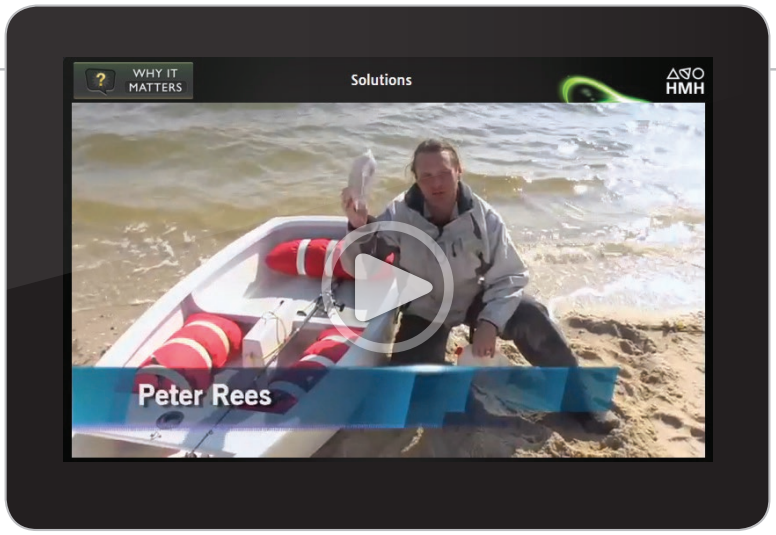
Mickey Sarquis, Professor *Emerita*, Chemistry Education, Miami University

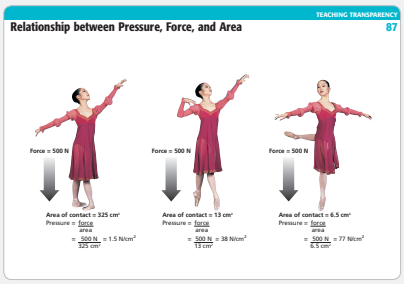
Meet the Authors

Dr. Jerry Sarquis and **Mickey Sarquis** were both professors in the Department of Chemistry at Miami University in Oxford, Ohio. These renowned authors were motivated to contribute to ***Modern Chemistry*** because they had a desire to give back to the community, and they wanted to influence students whom they couldn't even see, through the unfolding of a textbook and all the resources that support such a book. Jerry and Mickey Sarquis got into teaching because of their love of learning, and the more they taught, the more they learned from their interactions with their students.

Why It Matters Videos

Seventeen chapter-introductory videos are an effective way to **begin a new topic** of chemistry study. Each video is designed to take the content of the chapter and **relate it to everyday objects or situations** that are familiar to students.



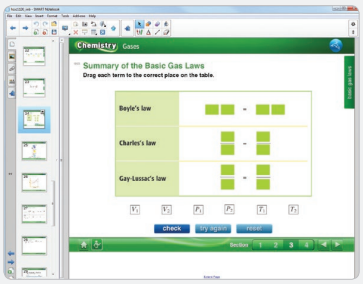


Teaching Visuals

Digital versions of key illustrations and diagrams are ideal for **whole-class instruction.**

PhET Simulations

Interactive online simulations produced under Creative Commons licensing by the University of Colorado at Boulder. They provide fun, interactive, **research-based simulations** of real-life phenomena.



Interactive Whiteboard Resources

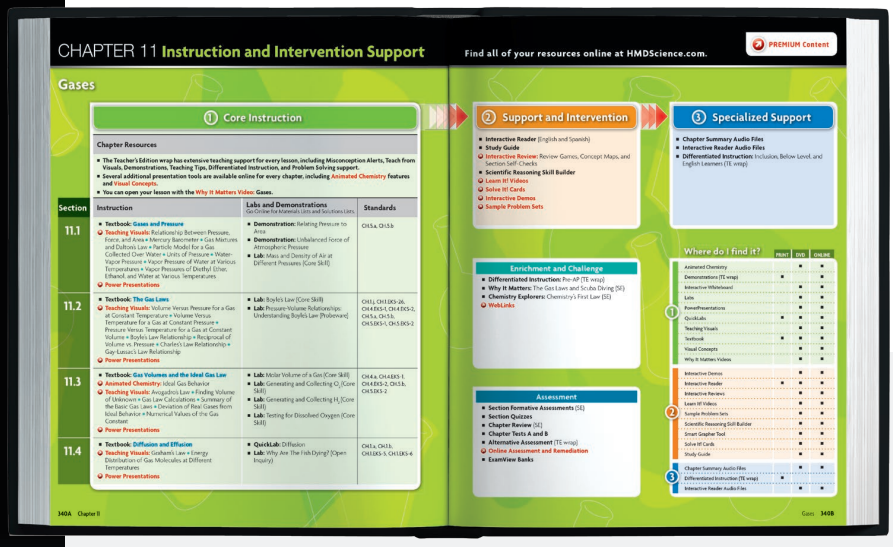
IWB resources include interactive **teaching visuals** and **content-reinforcement lessons** for each chapter of the textbook in SMART Notebook™ and ActivInspire® Flipchart formats.

Animated Chemistry

Each **Animated Chemistry** simulation includes three parts—an overview of the concept, an interactive simulation, and an assessment.

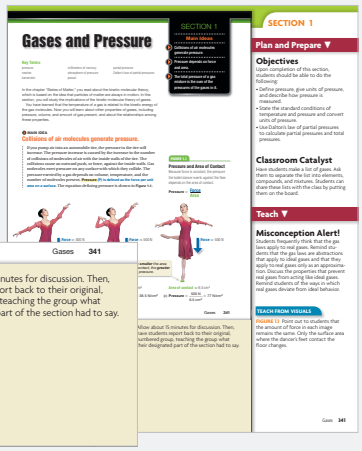
Unparalleled resources for Differentiated Instruction

Students approach chemistry with a wide variety of skills and levels of preparation. HMH *Modern Chemistry* provides you with the tools you need to help all students succeed.

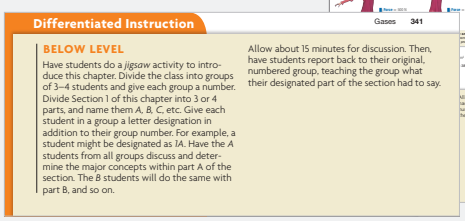


Teacher Edition

The **Instruction and Intervention** feature located in each chapter of the Teacher Edition provides **strategies for every lesson** to assist you in helping students with a wide range of needs. To simplify lesson planning, these support pages at the beginning of each chapter provide a full listing of the activities and classroom resources available for each section.

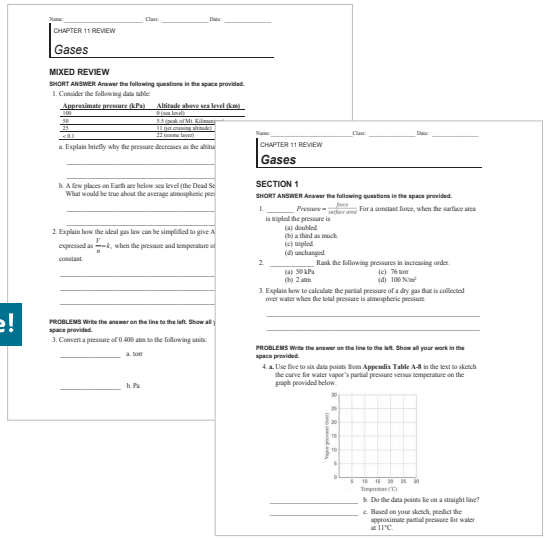


The wrap margin includes a **Differentiated Instruction** feature with a wide variety of strategies to help all students master chemistry concepts. Material categories include Below Level, English Learners, Pre-AP®, and Inclusion.



Chapter and Section Study Guide

The student worksheets in this guide cover the content in each section of the textbook using a **variety of questioning strategies.**



Interactive Reader Audio Files

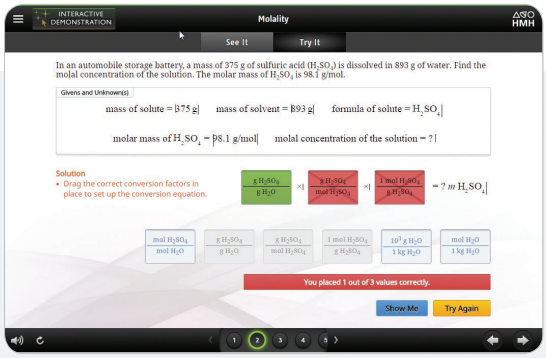
The entire Interactive Reader has been professionally read and is available to students to help **bolster learning comprehension.**

and Problem Solving

Nearly half of the sample problems in HMH *Modern Chemistry* have been refreshed to give even the most loyal program users something new and different to challenge and strengthen their students' problem-solving skills.

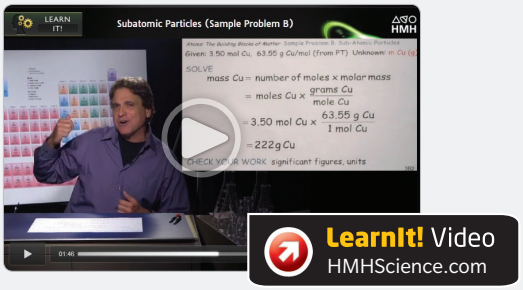
Solution Tutor

Guides students step-by-step through selected problems, recognizes their error patterns, then provides hints and targeted remediation to improve their problem-solving skills.



Interactive Demonstrations

Each sample problem in the textbook has an accompanying **Interactive Demonstration** that **walks through the steps of solving** that type of chemistry problem. The **Try It Yourself** feature helps students apply what they have learned. Each includes a full audio narrative.

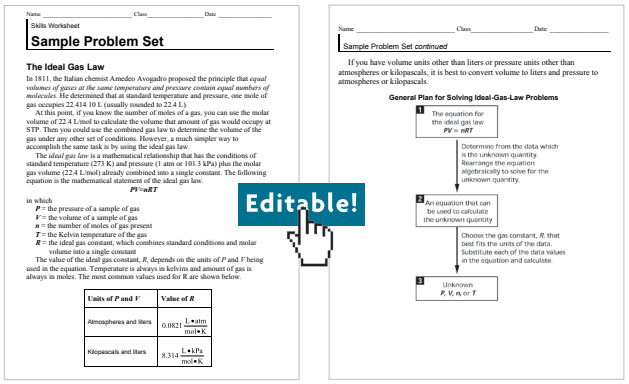


Learn It! Videos

Forty professional tutorial videos **walk students through challenging chemistry problems**, with tips and strategies for success.

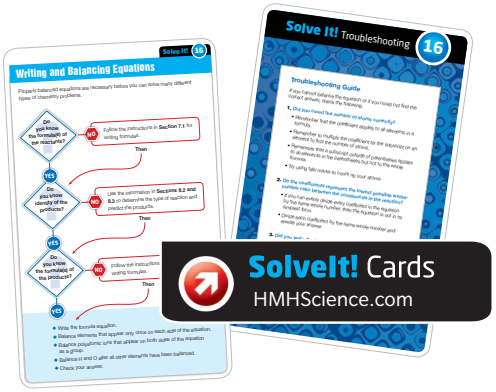
Sample Problem Sets

These skill worksheets provide **problem-solving strategies** and an extensive bank of student **practice problems** for every type of chemistry problem in the textbook.



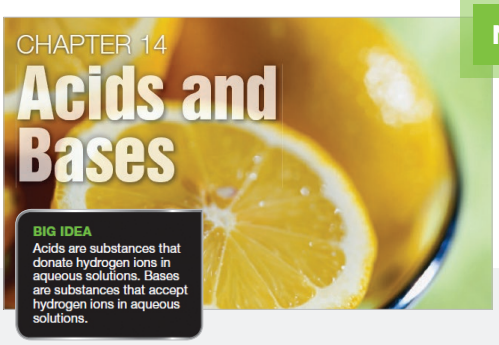
Solve It! Cards

These printable and **portable reference cards** provide students with quick access to effective problem-solving strategies and guidelines.



Wide-ranging support for Reading and Vocabulary

Your students will get the most out of their reading with numerous print and multimedia point-of-use resources that enable them to build understanding and retain more information on key concepts.



NEW!

Student Edition

Big Ideas in every Chapter Opener & Summary help students concentrate on key concepts.

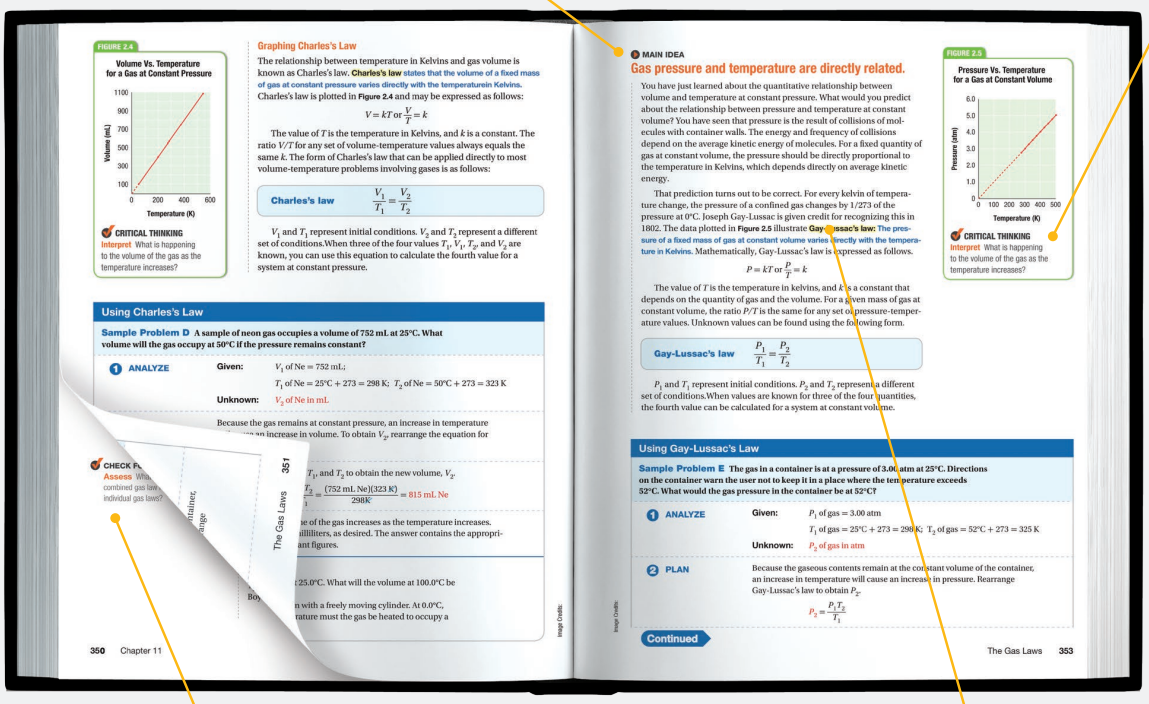
Main Idea

Chapter content has been organized around main ideas.

Critical Thinking

Critical-Thinking questions prompt your students to think deeply.

CRITICAL THINKING
Interpret What is happening to the volume of the gas as the temperature increases?



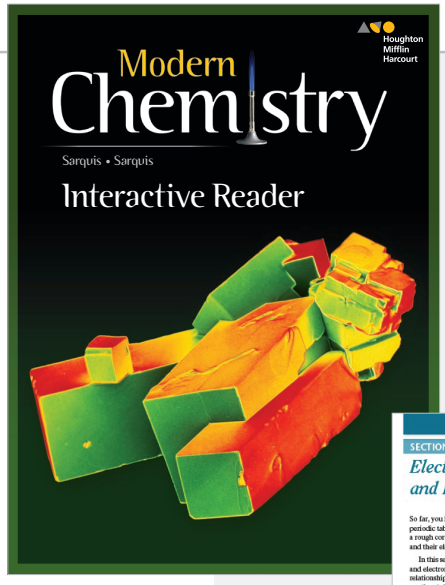
CHECK FOR UNDERSTANDING
Assess What advantage does the combined gas law have over the three individual gas laws?

Check for Understanding

These reading-comprehension questions help reinforce the important points of the section.

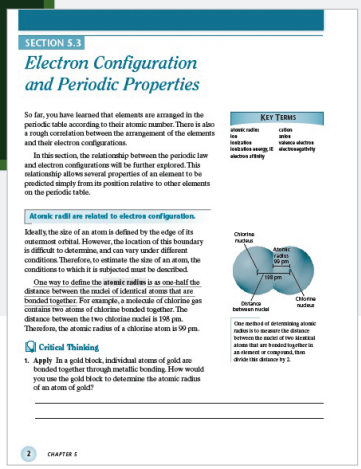
In-text definitions

As students study, they'll find key vocabulary has been highlighted in context.

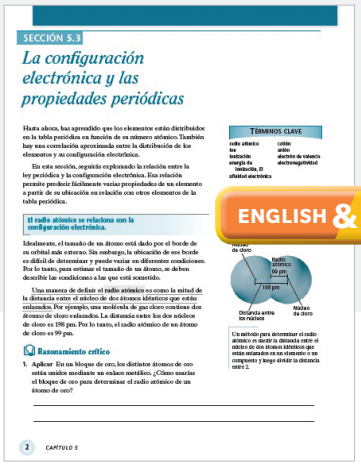


Interactive Reader

This write-in worktext presents all the vocabulary and essential content from the textbook in a lower-level, **easy-to-read** text, with instructional visuals and frequent comprehension checks. This unique component is a great tool for all students—the core content for struggling students and a useful **study guide** for others.

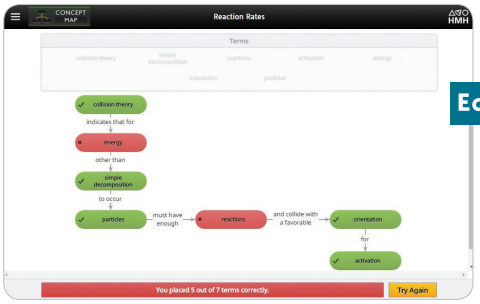

SECTION 5.3

Electron Configuration and Periodic Properties


SECCIÓN 5.3

La configuración electrónica y las propiedades periódicas

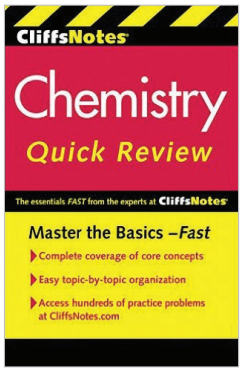
ENGLISH & SPANISH



Editable!

Interactive Concept Maps

Each chapter includes an interactive, advanced **graphic organizer** that shows the relationships among concepts covered and helps students develop logical thinking and study skills.



CliffsNotes® Chemistry Quick Review

With a Premium package purchase, a class set of these study guides provides **essential reinforcement of core concepts** in an easy-to-use format.

eBook

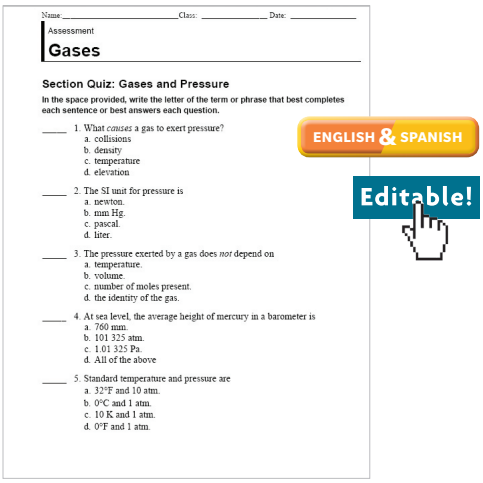
This **online version** of the print Student Edition features a wealth of **built-in tools** to help students access the content, including the chunking of content around Main Ideas, with frequent comprehension checks, superior support for problem solving, high-quality instructional visuals, point-of-use references to online animations, Problem-Solving tutorials, and virtual labs that make abstract concepts more concrete. Features include data persistence, on-page media links, bookmarking, search, notes, and highlighting functionality.

Flexible **Assessment Tools** to Track Student **Progress**

The comprehensive assessment options located on HMHScience.com bring together all HMH *Modern Chemistry* assessment tools into one convenient place, giving you many choices for the best way to assess your students' learning.

ExamView® Banks

A complete ExamView Software Suite includes all assessment questions for the program and more than **2,300 additional questions** in Bonus Banks.


Name:_____ Class: _____ Date: _____

Assessment
Gases

Section Quiz: Gases and Pressure

In the space provided, write the letter of the term or phrase that best completes each sentence or best answers each question.

____ 1. What *causes* a gas to exert pressure?
a. collisions
b. density
c. temperature
d. elevation

____ 2. The SI unit for pressure is
a. newton.
b. mm Hg.
c. pascal.
d. liter.

____ 3. The pressure exerted by a gas does *not* depend on
a. temperature.
b. volume.
c. number of moles present.
d. the identity of the gas.

____ 4. At sea level, the average height of mercury in a barometer is
a. 760 mm.
b. 101 325 atm.
c. 1.01 325 Pa.
d. All of the above

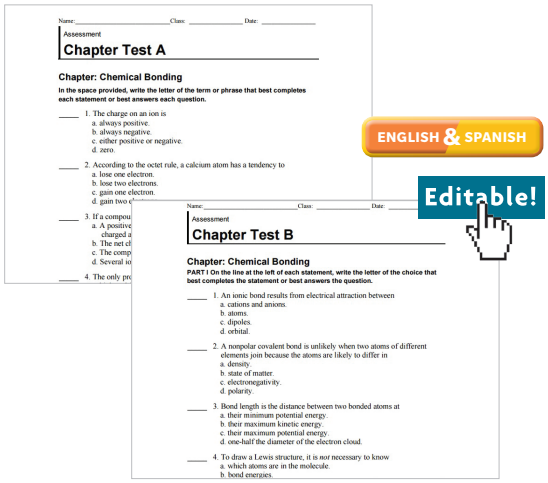
____ 5. Standard temperature and pressure are
a. 32°F and 10 atm.
b. 0°C and 1 atm.
c. 10 K and 1 atm.
d. 0°F and 1 atm.

ENGLISH & SPANISH

Editable!

Section Quizzes

A 10-question multiple-choice and short-answer quiz for each section of the textbook. These are designed for student **formative assessment** to aid in remediation.


Name:_____ Class: _____ Date: _____

Assessment
Chapter Test A

Chapter: Chemical Bonding

In the space provided, write the letter of the term or phrase that best completes each statement or best answers each question.

____ 1. The charge on an ion is
a. always positive.
b. always negative.
c. either positive or negative.
d. zero.

____ 2. According to the octet rule, a calcium atom has a tendency to
a. lose one electron.
b. lose two electrons.
c. gain one electron.
d. gain two e

____ 3. If a compou
a. A positive
charged a
b. The net el
c. The comp
d. Several io

____ 4. The only pro

Name:_____ Class: _____ Date: _____

Assessment
Chapter Test B

Chapter: Chemical Bonding

PART I On the line at the left of each statement, write the letter of the choice that best completes the statement or best answers the question.

____ 1. An ionic bond results from electrical attraction between
a. cations and anions.
b. atoms.
c. dipoles.
d. orbital.

____ 2. A nonpolar covalent bond is unlikely when two atoms of different elements join because the atoms are likely to differ in
a. density.
b. state of matter.
c. electronegativity.
d. polarity.

____ 3. Bond length is the distance between two bonded atoms at
a. their minimum potential energy.
b. their maximum kinetic energy.
c. their maximum potential energy.
d. one-half the diameter of the electron cloud.

____ 4. To draw a Lewis structure, it is *not* necessary to know
a. which atoms are in the molecule.
b. bond energies.

ENGLISH & SPANISH

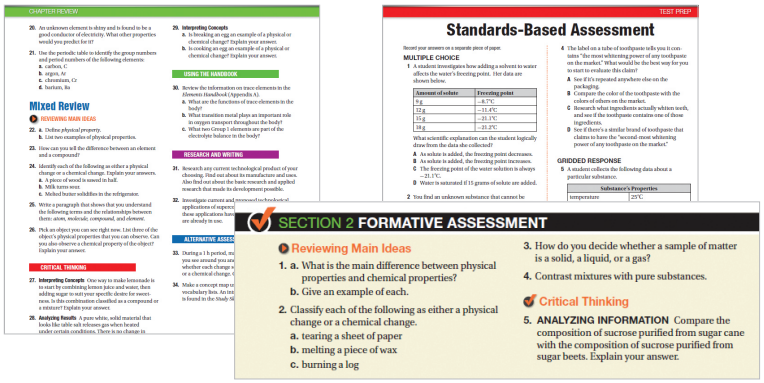
Editable!

Chapter Tests A & B

Two **full-length** chapter tests include multiple-choice and short-answer questions. Test B is similar to but more challenging than Test A.

Review and Assessment in the Student Edition

The Student Edition contains **multiple levels of assessment** from Formative to Summative, along with helpful review questions that assess students' understanding of chapter and section material.


CHAPTER REVIEW

Mixed Review

REVIEWING MAIN IDEAS

22. a. Define physical property.
b. List two examples of physical properties.

23. How can you tell the difference between an element and a compound?

24. Identify each of the following as either a physical change or a chemical change. Explain your answers.
a. A piece of wood is sawed in half.
b. Milk turns sour.
c. Melted butter solidifies in the refrigerator.

25. Write a paragraph that shows that you understand the following terms and the relationships between them: *atom, molecule, compound,* and *element.*

26. Pick an object you can see right now. List three of the object's physical properties that you can observe. Can you also observe a chemical property of the object? Explain your answer.

CRITICAL THINKING

27. **Interpreting Concepts** One way to make lemonade is to start by combining lemon juice and water, then adding sugar to suit your specific desire for sweetness. Is this combination classified as a compound or a mixture? Explain your answer.

28. **Analyzing Results** A pure white, solid material that looks like table salt releases gas when heated under certain conditions. There is no change in

29. **Interpreting Concepts**
a. Is breaking an egg an example of a physical or chemical change? Explain your answer.
b. Is cooking an egg an example of a physical or chemical change? Explain your answer.

USING THE HANDBOOK

30. Review the information on trace elements in the *Elements Handbook* (Appendix A).
a. What are the functions of trace elements in the body?
b. What transition metal plays an important role in oxygen transport throughout the body?
c. What two Group 1 elements are part of the electrolyte balance in the body?

RESEARCH AND WRITING

31. Research any current technological product of your choosing. Find out about its manufacture and uses. Also find out about the basic research and applied research that made its development possible.

32. Investigate current and renewed technologies of applications of superc
these applications ha
are already in use.

ALTERNATIVE ASSES

33. During a 1 h period, m
you see around you an
whether each change
or a chemical change.

34. Make a concept map u
vocabulary lists. An int
is found in the Study Gu

TEST PREP

Standards-Based Assessment

Record your answers on a separate piece of paper.

MULTIPLE CHOICE

1 A student investigates how adding a solvent to water affects the water's freezing point. Her data are shown below.

Amount of solute	Freezing point
9 g	−8.7°C
12 g	−11.4°C
15 g	−21.1°C
18 g	−21.2°C

What scientific explanation can the student logically draw from the data she collected?
A As solute is added, the freezing point decreases.
B As solute is added, the freezing point increases.
C The freezing point of the water solution is always −21.1°C.
D Water is saturated if 15 grams of solute are added.

2 You find an unknown substance that cannot be

4 The label on a tube of toothpaste tells you it contains "the most whitening power of any toothpaste on the market." What would be the best way for you to start to evaluate this claim?
A See if it's repeated anywhere else on the packaging.
B Compare the color of the toothpaste with the colors of others on the market.
C Research what ingredients actually whiten teeth, and see if the toothpaste contains one of those ingredients.
D See if there's a similar brand of toothpaste that claims to have the "second-most whitening power of any toothpaste on the market."

GRIDDED RESPONSE

5 A student collects the following data about a particular substance.

Substance's Properties	
temperature	25°C

SECTION 2 FORMATIVE ASSESSMENT

Reviewing Main Ideas

1. a. What is the main difference between physical properties and chemical properties?
b. Give an example of each.

2. Classify each of the following as either a physical change or a chemical change.
a. tearing a sheet of paper
b. melting a piece of wax
c. burning a log

3. How do you decide whether a sample of matter is a solid, a liquid, or a gas?

4. Contrast mixtures with pure substances.

Critical Thinking

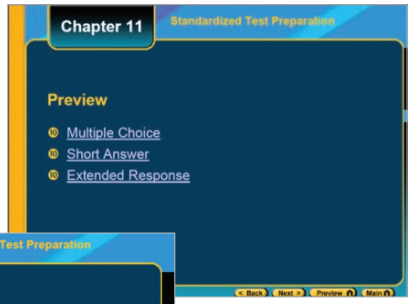
5. **ANALYZING INFORMATION** Compare the composition of sucrose purified from sugar cane with the composition of sucrose purified from sugar beets. Explain your answer.

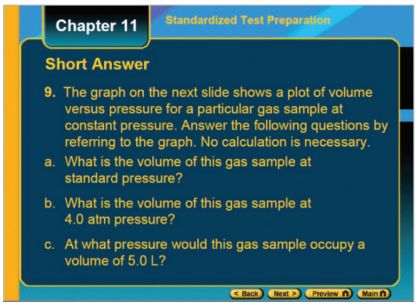
Interactive Review Games

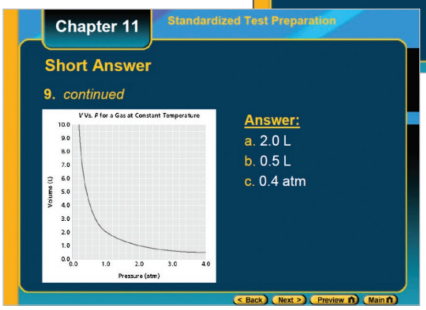
Three different styles of vocabulary and concept review games help reinforce the material learned in each chapter in a fun and engaging format.

PowerPresentations: Standardized Test Preparation

Multiple-Choice, Short-Answer, and Extended-Response questions that you can use for **whole-class review** of chapter materials.





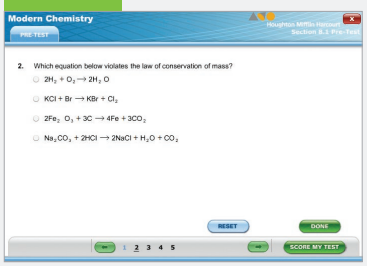


Online Assessment and Remediation

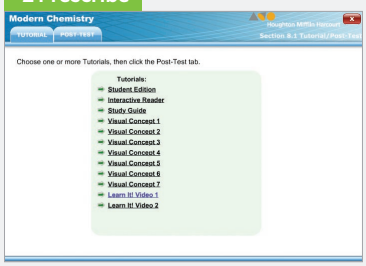
An advanced, automated assessment and remediation engine enables teachers to assign section quizzes to students. The assessments are **automatically graded**, and remediation that uses materials from the program is prescribed. A post-test is offered to determine student mastery. Critical student **performance data** are recorded and made readily available to the teacher.

Individualized Remediation

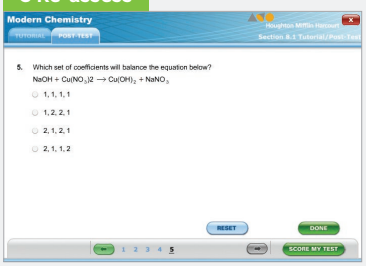
1 Assess



2 Prescribe



3 Re-assess



Convenient access to Labs, Data Analysis and STEM

HMH *Modern Chemistry* includes the most comprehensive lab resources with its wide variety of print and digital lab options for every classroom, along with the most robust data-analysis strand to help students develop these critical skills.

Over 200 Editable Labs!

Laboratory Experiments

Wide variety of labs located at point of use on **HMHScience.com**:

- Editable lab sheets
- Teacher notes and answer keys
- Referenced on Instruction and Intervention pages in Teacher Edition

QuickLabs

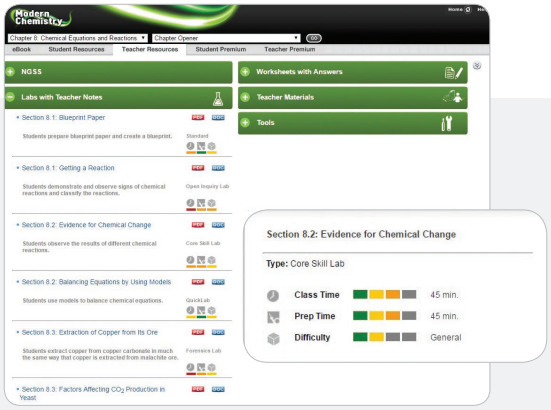
Designed for reinforcement of key concepts using easy-to-obtain materials

Standard Labs

Focus on experimental skills and application of chapter concepts through the use of scientific methods

Core Skill Labs

Provide practice of inquiry skills and scientific methods

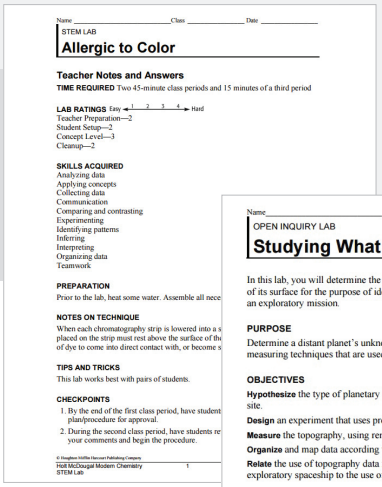


Labeled Labs

Lab activities are labeled online by **class time**, **prep time**, and **difficulty** to help teachers choose appropriate activities to fit their classroom needs.

STEM Labs

Science, Technology, Engineering, and Mathematics problem-based labs that emphasize inquiry and the engineering design process


Name _____ Class _____ Date _____

STEM LAB

Allergic to Color

Teacher Notes and Answers

TIME REQUIRED Two 45-minute class periods and 15 minutes of a third period

LAB RATINGS Easy 1 2 3 4 Hard
Teacher Preparation—2
Student Setup—2
Concept Level—3
Cleanup—2

SKILLS ACQUIRED
Analyzing data
Applying concepts
Collecting data
Communication
Comparing and contrasting
Experimenting
Identifying patterns
Inferring
Interpreting
Organizing data
Teamwork

PREPARATION
Prior to the lab, heat some water. Assemble all nece

NOTES ON TECHNIQUE
When each chromatography strip is lowered into a s
placed on the strip must rest above the surface of th
of dye to come into direct contact with, or become s

TIPS AND TRICKS
This lab works best with pairs of students.

CHECKPOINTS
1. By the end of the first class period, have student plan/procedure for approval.
2. During the second class period, have students re your comments and begin the procedure.

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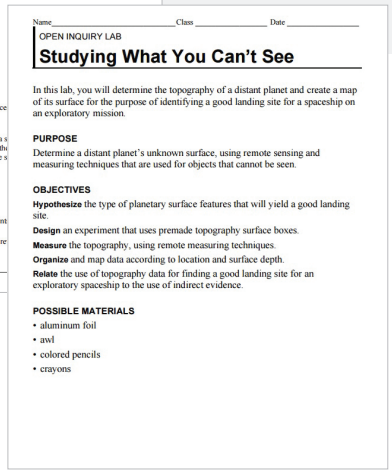
Holt McDougal Modern Chemistry 1
STEM Lab

STEM labs


Name _____ Class _____ Date _____

OPEN INQUIRY LAB

Studying What You Can't See

In this lab, you will determine the topography of a distant planet and create a map of its surface for the purpose of identifying a good landing site for a spaceship on an exploratory mission.

PURPOSE
Determine a distant planet's unknown surface, using remote sensing and measuring techniques that are used for objects that cannot be seen.

OBJECTIVES
Hypothesize the type of planetary surface features that will yield a good landing site.
Design an experiment that uses premade topography surface boxes.
Measure the topography, using remote measuring techniques.
Organize and map data according to location and surface depth.
Relate the use of topography data for finding a good landing site for an exploratory spaceship to the use of indirect evidence.

POSSIBLE MATERIALS
- aluminum foil
- awl
- colored pencils
- crayons

Inquiry labs

Open Inquiry Labs

Specifically designed to be short project-based labs that encourage students to collaborate, strategize, construct, and evaluate a lab challenge of their own creation

Probeware Labs

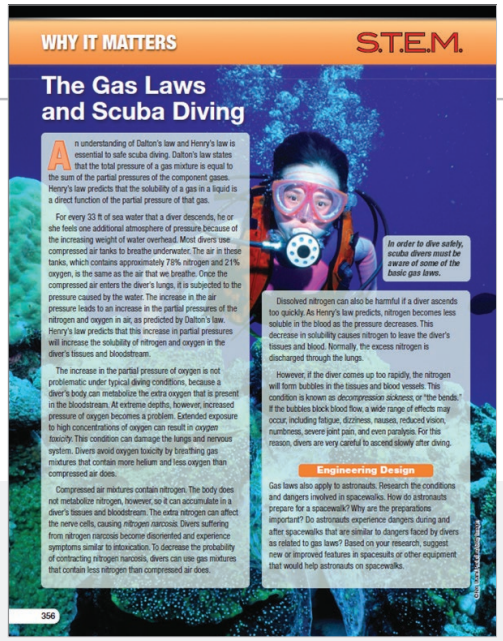
Labs that use Vernier® probeware and Pasco® probeware and SPARK® technology

Forensic Labs

Application labs that have students demonstrating laboratory skills through the exploration of forensic and applied science scenarios

S.T.E.M. in the Student Edition

Select STEM features include an Engineering Design feature in the Student Edition. This feature encourages students to follow the **engineering design process** and think about problems in an innovative way.



WHY IT MATTERS S.T.E.M.

The Gas Laws and Scuba Diving

An understanding of Dalton's law and Henry's law is essential to safe scuba diving. Dalton's law states that the total pressure of a gas mixture is equal to the sum of the partial pressures of the component gases. Henry's law predicts that the solubility of a gas in a liquid is a direct function of the partial pressure of that gas.

For every 33 ft of sea water that a diver descends, he or she feels one additional atmosphere of pressure because of the increasing weight of water overhead. Most divers use compressed air tanks to breathe underwater. The air in these tanks, which contains approximately 78% nitrogen and 21% oxygen, is the same as the air that we breathe. Once the compressed air enters the diver's lungs, it is subjected to the pressure caused by the water. The increase in the air pressure leads to an increase in the partial pressures of the nitrogen and oxygen in air, as predicted by Dalton's law. Henry's law predicts that this increase in partial pressures will increase the solubility of nitrogen and oxygen in the diver's tissues and bloodstream.

The increase in the partial pressure of oxygen is not problematic under typical diving conditions, because a diver's body can metabolize the extra oxygen that is present in the bloodstream. At extreme depths, however, increased pressure of oxygen becomes a problem. Extended exposure to high concentrations of oxygen can result in *oxygen toxicity*. This condition can damage the lungs and nervous system. Divers avoid oxygen toxicity by breathing gas mixtures that contain more helium and less oxygen than compressed air does.

Compressed air mixtures contain nitrogen. The body does not metabolize nitrogen, however, so it can accumulate in a diver's tissues and bloodstream. The extra nitrogen can affect the nerve cells, causing *nitrogen narcosis*. Divers suffering from nitrogen narcosis become disoriented and experience symptoms similar to intoxication. To decrease the probability of contracting nitrogen narcosis, divers can use gas mixtures that contain less nitrogen than compressed air does.

In order to dive safely, scuba divers must be aware of some of the basic gas laws.

Dissolved nitrogen can also be harmful if a diver ascends too quickly. As Henry's law predicts, nitrogen becomes less soluble in the blood as the pressure decreases. This decrease in solubility causes nitrogen to leave the diver's tissues and blood. Normally, the excess nitrogen is discharged through the lungs.

However, if the diver comes up too rapidly, the nitrogen will form bubbles in the tissues and blood vessels. This condition is known as *decompression sickness*, or "the bends." If the bubbles block blood flow, a wide range of effects may occur, including fatigue, dizziness, nausea, reduced vision, numbness, severe joint pain, and even paralysis. For this reason, divers are very careful to ascend slowly after diving.

Engineering Design

Gas laws also apply to astronauts. Research the conditions and dangers involved in spacewalks. How do astronauts prepare for a spacewalk? Why are the preparations important? Do astronauts experience dangers during and after spacewalks that are similar to dangers faced by divers as related to gas laws? Based on your research, suggest new or improved features in spacesuits or other equipment that would help astronauts on spacewalks.

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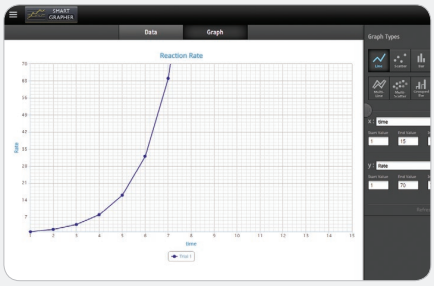
Data Analysis Support for Students

To help students develop the data analysis skills necessary to collect, graph, and analyze data like scientists, **HMHScience.com** includes resources to support the data analysis lesson in every chapter.



Smart Grapher

A powerful, easy-to-use **online graphing tool** that encourages students to use their own data to create line graphs, circle graphs, and more.

Scientific Reasoning Skill Builder

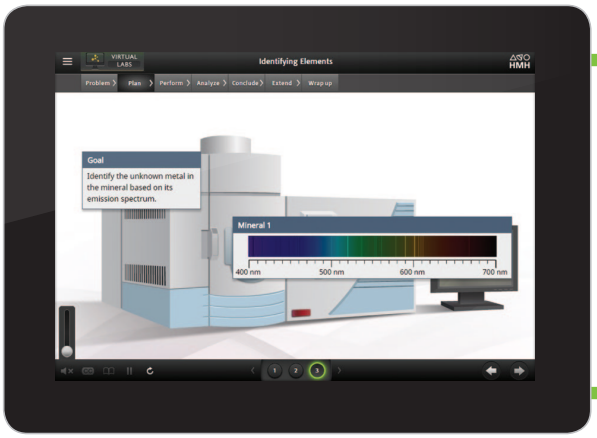
Over **100 exercises** that strengthen students' scientific-reasoning skills. Sample topics include classifying and categorizing, cause-and-effect relationships, hypothesis, generalizations and analogies, and summarizing and reviewing.

Pre-Lab Procedures

This resource provides **Teacher Resource Pages** and worksheets to help students develop the skills necessary to complete chapter labs.

Graphing Calculator Activities

HMH has partnered with Texas Instruments® to present nine **graphing activities** for use with the TI-Nspire® graphing calculator.



Virtual Labs

Students can hone their lab skills in a virtual environment. Fun, safe, and highly interactive, these labs focus on experiments for which equipment and materials are often expensive or difficult to acquire.