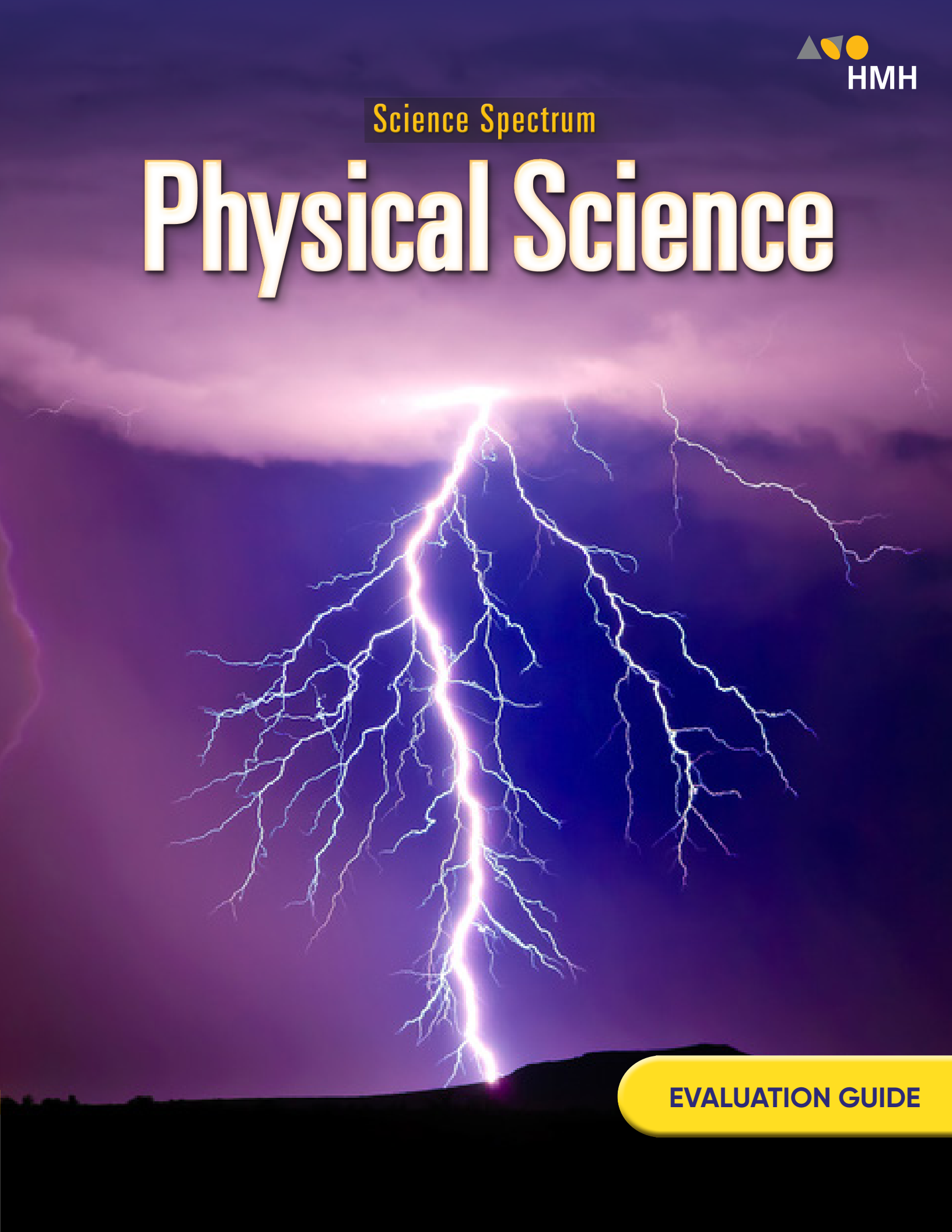
HMH

Science Spectrum

Physical Science



EVALUATION GUIDE

Welcome to *Holt Science Spectrum*

Learn to think like a scientist . . .

Houghton Mifflin Harcourt's introductory physical science program integrates chemistry, physics, Earth science, space science, and applied mathematics. The program emphasizes the important connections between these subjects and their cross-disciplinary applications and helps students think analytically, like scientists.

THE HMH® ADVANTAGE

Science Spectrum® addresses the key challenges science teachers face. The program is designed to be easy to follow and easy to use.

- **Reading Toolbox** helps improve students' reading comprehension and retention through conceptual organization.
- **Why It Matters** strand makes science relevant to students and piques their interest.
- **Inquiry-driven, hands-on learning** reinforces the science concepts students are studying.
- Point-of-use **Math** and **Science Skills** features help students succeed in science.
- Strong support for **differentiated instruction** makes **Holt Science Spectrum** accessible to a diverse student population.

Table of Contents

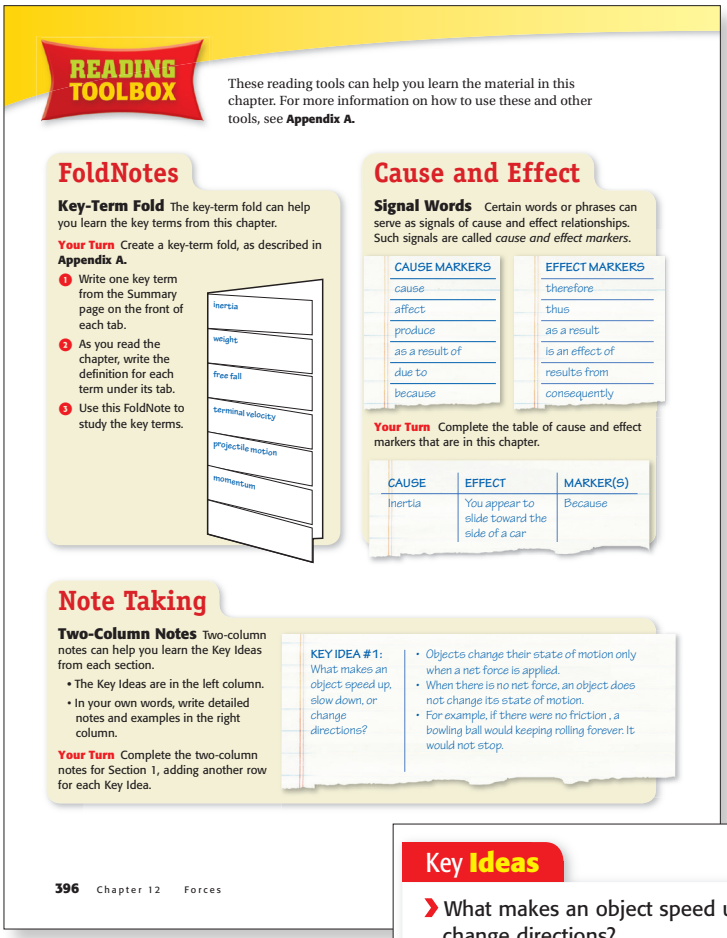
PHYSICAL SCIENCE CHAPTERS

EARTH AND SPACE SCIENCE CHAPTERS

Integrating:

- ✓ Chemistry
- ✓ Physics
- ✓ Earth Science
- ✓ Space Science
- ✓ Mathematics

Reading Support Unlocks Science Content



READING TOOLBOX

These reading tools can help you learn the material in this chapter. For more information on how to use these and other tools, see **Appendix A.**

FoldNotes

Key-Term Fold The key-term fold can help you learn the key terms from this chapter.

Your Turn Create a key-term fold, as described in **Appendix A.**

1. Write one key term from the Summary page on the front of each tab.
2. As you read the chapter, write the definition for each term under its tab.
3. Use this FoldNote to study the key terms.

inertia
weight
free fall
terminal velocity
projectile motion
momentum

Cause and Effect

Signal Words Certain words or phrases can serve as signals of cause and effect relationships. Such signals are called *cause and effect markers.*

CAUSE MARKERS	EFFECT MARKERS
cause	therefore
affect	thus
produce	as a result
as a result of	is an effect of
due to	results from
because	consequently

Your Turn Complete the table of cause and effect markers that are in this chapter.

CAUSE	EFFECT	MARKER(S)
Inertia	You appear to slide toward the side of a car	Because

Note Taking

Two-Column Notes Two-column notes can help you learn the Key Ideas from each section.

- The Key Ideas are in the left column.
- In your own words, write detailed notes and examples in the right column.

Your Turn Complete the two-column notes for Section 1, adding another row for each Key Idea.

KEY IDEA #1: What makes an object speed up, slow down, or change directions?	• Objects change their state of motion only when a net force is applied. • When there is no net force, an object does not change its state of motion. • For example, if there were no friction, a bowling ball would keeping rolling forever. It would not stop.

396 Chapter 12 Forces

Every chapter begins with tools such as **Graphic Organizers** or **FoldNotes** to help students access key science content. These tools are suggested again at point of use within the chapter. The first question in every **Chapter Review** provides practice using a **Reading Toolbox** application. Additionally, the Teacher's Edition provides toolbox suggestions in the margin wrap.

Key Ideas

- What makes an object speed up, slow down, or change directions?
- What determines how much an object speeds up or slows down?

Each section begins with questions that guide students' reading and provide focus. These **Key Ideas** are emphasized within the running narrative with red icons.

Important points are also reinforced with questions that check students' reading comprehension.

Reading Check **What is the SI unit for power?** (See Appendix E for answers to Reading Checks.)

Power

Running up a flight of stairs does not require more work than walking up slowly does, but running is more exhausting than walking. The amount of time that a given amount of work takes is an important factor when you conside machines. The quantity that measures work i is **power.** **Power is the rate at which work is much work is done in a given amount of tim**

Power equation $power = \frac{work}{time}$ $P =$

power (POW uhr) a quantity that measures the rate at which work is done or energy is transformed

Academic Vocabulary

factor (FAK tuhr) a condition or event that brings about a result

KEY TERMS

Scientific Vocabulary is highlighted in context and defined in the margin for quick reference. **Academic Vocabulary** provides definitions of terms that are frequently used in science.

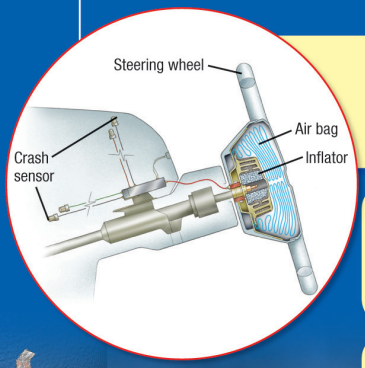
Why It Matters Captures Students' Interest

Why It **Matters**

How Do Air Bags Work?

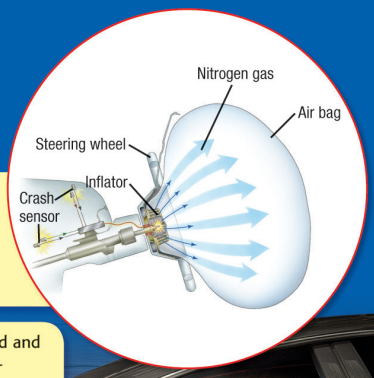
REAL WORLD

Air bags are standard equipment in every new automobile sold in the United States. In a collision, air bags explode from a compartment to cushion the passenger's head. By decreasing the acceleration of a passenger's head and body during a crash, an air bag reduces the force acting on the passenger and makes injuries less likely. Air bags are credited with saving more than 5,000 lives between 1986 and 2000.



1. When a car comes to an abrupt stop, sensors in the car detect the sudden change in speed and trigger a chemical reaction inside the air bags.

2. This reaction very quickly produces nitrogen gas, which causes the bags to inflate and explode out of their storage compartments in a fraction of a second.



3. The inflated air bags cushion the head and upper body of the driver and the passenger in the front seat, who keep moving forward at the time of impact because of their inertia.

SCILINKS
www.scilinks.org
Topic: Newton's First Law
Code: HK81027

YOUR TURN

UNDERSTANDING CONCEPTS

1. Are air bags useful if a car is struck from behind by another vehicle?

CRITICAL THINKING

2. If a car has air bags, do the passengers need to wear seat belts? Explain why or why not.

Section 1 Newton's First and Se

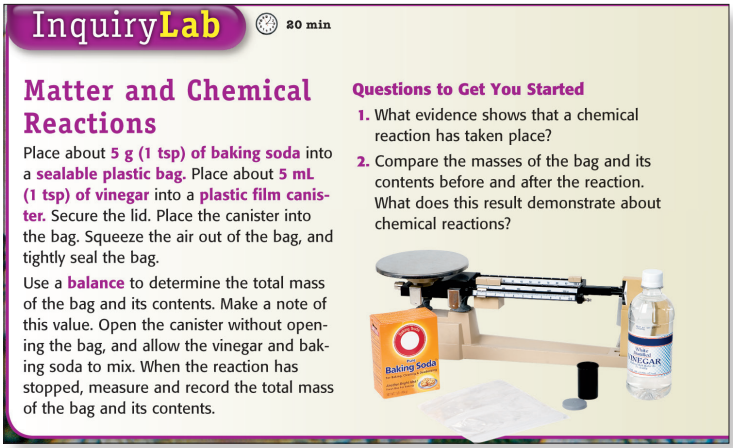
Why It Matters

Newton's second law of motion helps explain how air bags have saved lives.

Designed more like a magazine layout than a textbook page, **Why It Matters** features capture students' interest and make science relevant in the context of real-world science, weird science, or science and society.

Each chapter and section also begins by emphasizing the relevance of the lesson content to students' everyday lives with **Why It Matters** explanations.

Inquiry and Hands-On Learning Reinforce Key Science Concepts


InquiryLab

20 min

Matter and Chemical Reactions

Place about **5 g (1 tsp) of baking soda** into a **sealable plastic bag.** Place about **5 mL (1 tsp) of vinegar** into a **plastic film canister.** Secure the lid. Place the canister into the bag. Squeeze the air out of the bag, and tightly seal the bag.

Use a **balance** to determine the total mass of the bag and its contents. Make a note of this value. Open the canister without opening the bag, and allow the vinegar and baking soda to mix. When the reaction has stopped, measure and record the total mass of the bag and its contents.

Questions to Get You Started

1. What evidence shows that a chemical reaction has taken place?
2. Compare the masses of the bag and its contents before and after the reaction. What does this result demonstrate about chemical reactions?

INQUIRY LABS

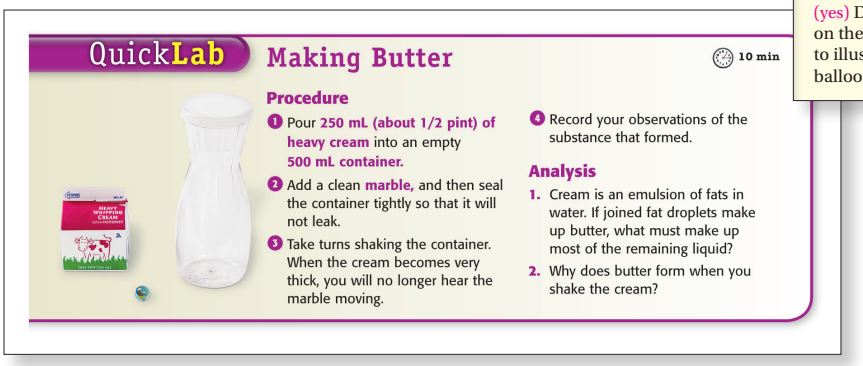
Chapters begin with an inquiry-driven activity to get students thinking about the science content they are about to study.

Demonstrate

Gravity Fill a round balloon with air and let it rest freely on your open hand. Ask: "What force is keeping this balloon on my hand?" (gravity). Explain to students that all objects in the universe attract each other through the force of gravity. In this case, the balloon and the Earth are attracting each other, but your hand is preventing the balloon's fall. Let the balloon fall to the floor, and draw on the board the path of the balloon. Next, place the balloon on your hand once more and tap the balloon so it moves off your hand horizontally and falls to the floor. Ask: "Does gravity still affect the balloon when it is in motion?" (yes) Draw the path of the balloon on the board again, using arrows to illustrate the forces acting on the balloon. LS Visual

DEMONSTRATIONS

"Show and Tell" suggestions for science concepts are located in the margin of the Teacher's Edition.


QuickLab

Making Butter

10 min

Procedure

1. Pour **250 mL (about 1/2 pint) of heavy cream** into an empty **500 mL container.**
2. Add a clean **marble,** and then seal the container tightly so that it will not leak.
3. Take turns shaking the container. When the cream becomes very thick, you will no longer hear the marble moving.
4. Record your observations of the substance that formed.

Analysis

1. Cream is an emulsion of fats in water. If joined fat droplets make up butter, what must make up most of the remaining liquid?
2. Why does butter form when you shake the cream?

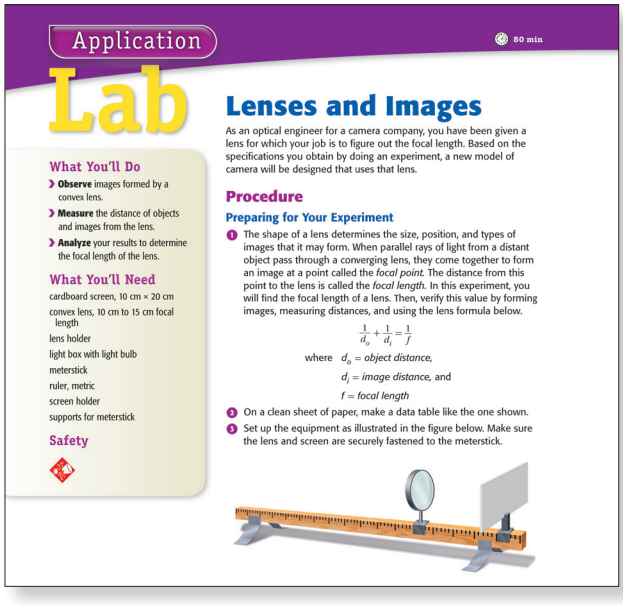
QUICK LABS

Short, hands-on activities in every section highlight key science concepts with few demands on time and equipment.

CHAPTER LABS

End-of-chapter labs focus on experimental skills and test scientific principles through the use of scientific methods. Leveled datasheets for basic, general, and advanced learners are available for every chapter lab.

Additional labs correlated to each chapter are available in the **Chapter Resources** and include **Skills Practice, CBL™ Probeware,** and **Inquiry** labs.


Application Lab

80 min

Lenses and Images

As an optical engineer for a camera company, you have been given a lens for which your job is to figure out the focal length. Based on the specifications you obtain by doing an experiment, a new model of camera will be designed that uses that lens.

What You'll Do

- **Observe** images formed by a convex lens.
- **Measure** the distance of objects and images from the lens.
- **Analyze** your results to determine the focal length of the lens.

What You'll Need

cardboard screen, 10 cm × 20 cm
convex lens, 10 cm to 15 cm focal length
lens holder
light box with light bulb
meterstick
ruler, metric
screen holder
supports for meterstick

Safety

Procedure

Preparing for Your Experiment

1. The shape of a lens determines the size, position, and types of images that it may form. When parallel rays of light from a distant object pass through a converging lens, they come together to form an image at a point called the *focal point.* The distance from this point to the lens is called the *focal length.* In this experiment, you will find the focal length of a lens. Then, verify this value by forming images, measuring distances, and using the lens formula below.

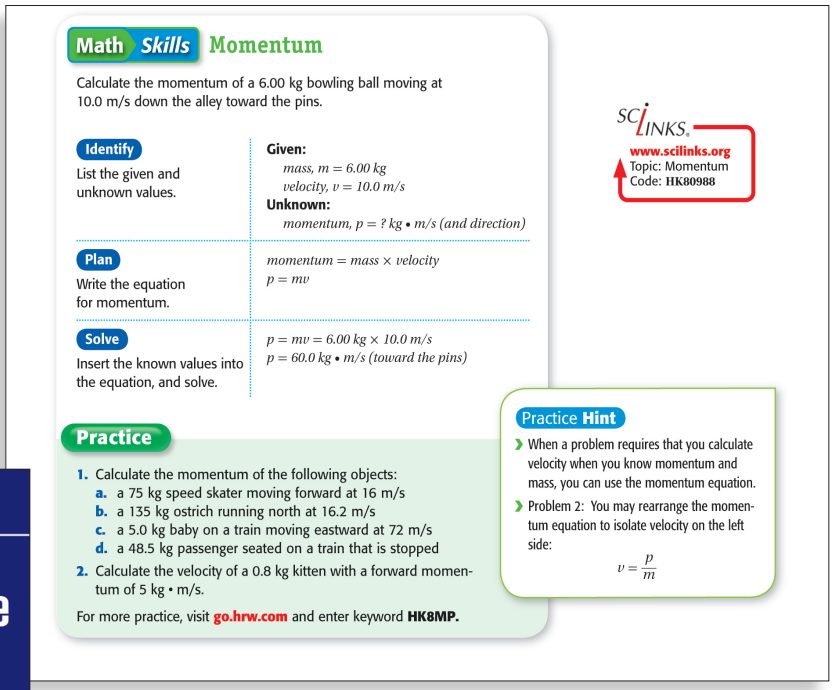
$$\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$$

where d_o = *object distance,*
d_i = *image distance,* and
f = *focal length*

2. On a clean sheet of paper, make a data table like the one shown.
3. Set up the equipment as illustrated in the figure below. Make sure the lens and screen are securely fastened to the meterstick.

Developing Math and Science Skills Is Key to Student Success

Math Skills link mathematics directly to the science being presented. Problem-solving graphics demonstrate the natural links between these two disciplines. Following the solved problem, students are presented with applications that check their understanding.



Math Skills Momentum

Calculate the momentum of a 6.00 kg bowling ball moving at 10.0 m/s down the alley toward the pins.

Identify
List the given and unknown values.

Given:
mass, m = 6.00 kg
velocity, v = 10.0 m/s
Unknown:
momentum, p = ? kg • m/s (and direction)

Plan
Write the equation for momentum.

momentum = mass × velocity
$p = mv$

Solve
Insert the known values into the equation, and solve.

$p = mv = 6.00\ kg \times 10.0\ m/s$
$p = 60.0\ kg \cdot m/s$ *(toward the pins)*

SCILINKS
www.scilinks.org
Topic: Momentum
Code: HK80988

Practice

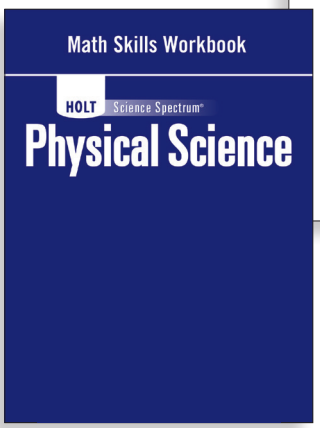
1. Calculate the momentum of the following objects:
   a. a 75 kg speed skater moving forward at 16 m/s
   b. a 135 kg ostrich running north at 16.2 m/s
   c. a 5.0 kg baby on a train moving eastward at 72 m/s
   d. a 48.5 kg passenger seated on a train that is stopped
2. Calculate the velocity of a 0.8 kg kitten with a forward momentum of 5 kg • m/s.

For more practice, visit go.hrw.com and enter keyword **HK8MP.**

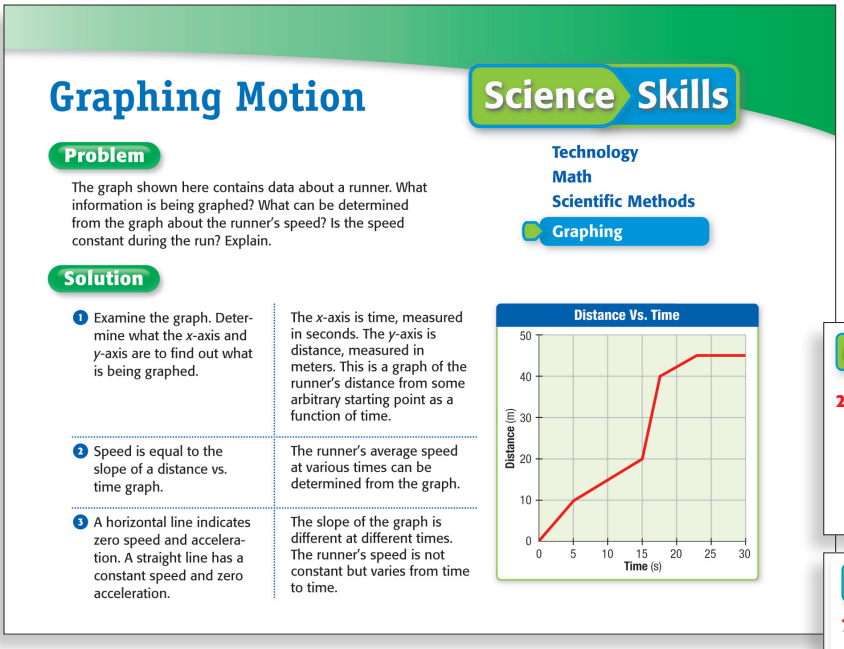
Practice Hint

- When a problem requires that you calculate velocity when you know momentum and mass, you can use the momentum equation.
- Problem 2: You may rearrange the momentum equation to isolate velocity on the left side:

$$v = \frac{p}{m}$$



Math Skills Workbook provides additional remediation and practice for students who need extra support.



Graphing Motion

Science Skills

Technology
Math
Scientific Methods
Graphing

Problem

The graph shown here contains data about a runner. What information is being graphed? What can be determined from the graph about the runner's speed? Is the speed constant during the run? Explain.

Solution

1 Examine the graph. Determine what the *x*-axis and *y*-axis are to find out what is being graphed.	The *x*-axis is time, measured in seconds. The *y*-axis is distance, measured in meters. This is a graph of the runner's distance from some arbitrary starting point as a function of time.
2 Speed is equal to the slope of a distance vs. time graph.	The runner's average speed at various times can be determined from the graph.
3 A horizontal line indicates zero speed and acceleration. A straight line has a constant speed and zero acceleration.	The slope of the graph is different at different times. The runner's speed is not constant but varies from time to time.

Science Skills in every chapter develop students' science skills in the context of the content that they are studying. Skills focus includes technology, math, scientific methods, and graphing. Additionally, these skills are practiced in the **Section** and **Chapter Reviews**.

Graphing Skills

24. Line Graphs An experiment is done using a lab cart. Varying forces are applied to the cart and measured while the cart is accelerating. Each force is applied in the same direction as the movement of the cart. The following data are obtained from the experiment.

Math Skills

7. Calculate the momentum of a 1 kg ball that is moving eastward at 12 m/s.

Differentiated Instruction Helps You Reach All Your Students

Differentiated Instruction

Special Education Students

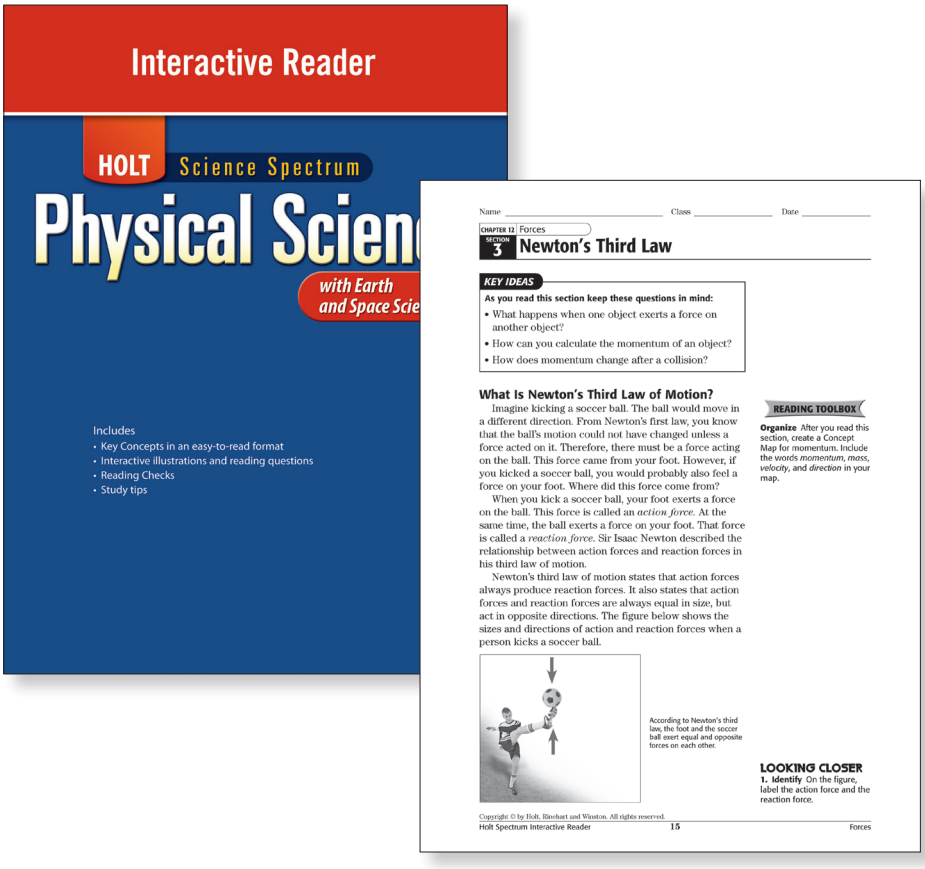
Mass Judgments Gather 15 or 20 different-sized, solid-mass items, such as marbles, books, or heavy backpacks. Randomly pair the items. Select two pairs. Ask students which of the two pairs has greater gravitational force. Continue until all pairs are addressed. Then, choose two items and ask a volunteer to choose two other items that have more or less gravitational force. LS Kinesthetic

Differentiated Instruction

Advanced Learners

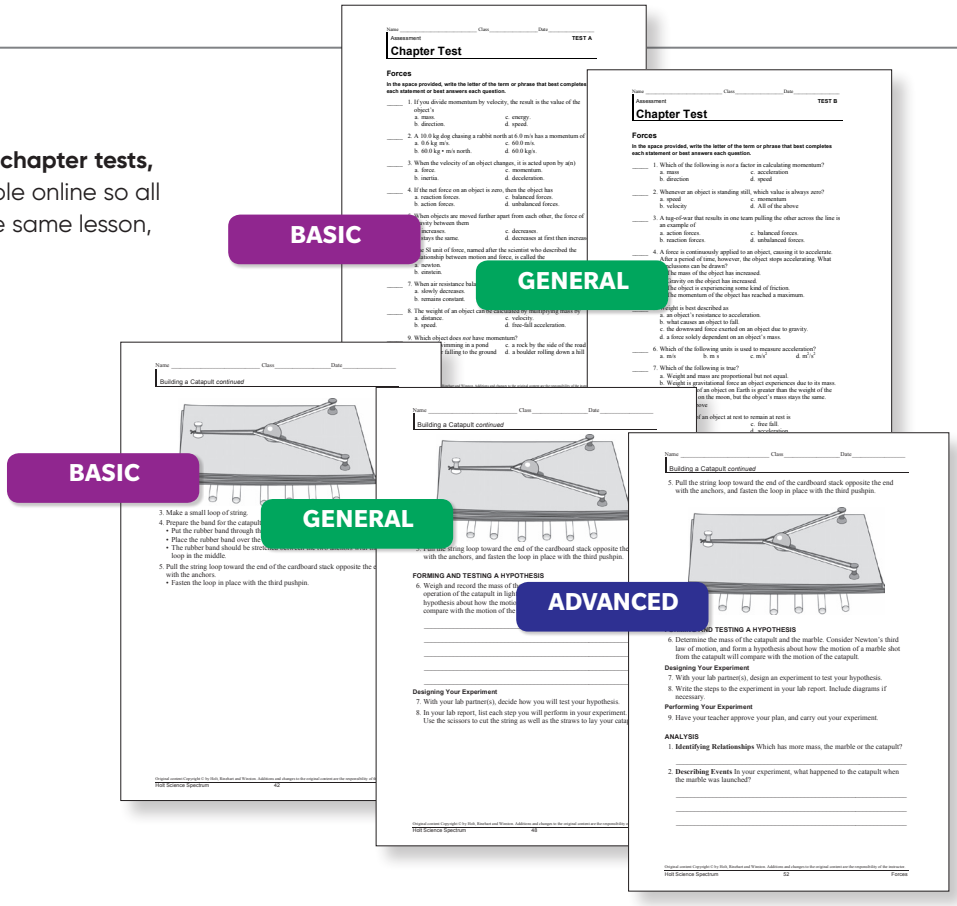
Terminal Velocity The acceleration due to gravity is the same for all objects, regardless of weight (disregarding air resistance). Ask students to explain whether terminal velocity for an object falling in air depends on the object's weight. (Yes. Terminal velocity is the point where air resistance equals weight, so if weight changes, a different amount of air resistance will be needed to balance the force of gravity. Therefore, a different terminal velocity will be achieved.) LS Logical

The Teacher's Edition margin wrap provides strategies for differentiating instruction at point of use for important science content. These strategies are referenced in the **Chapter Planning Guide** at the beginning of each chapter.



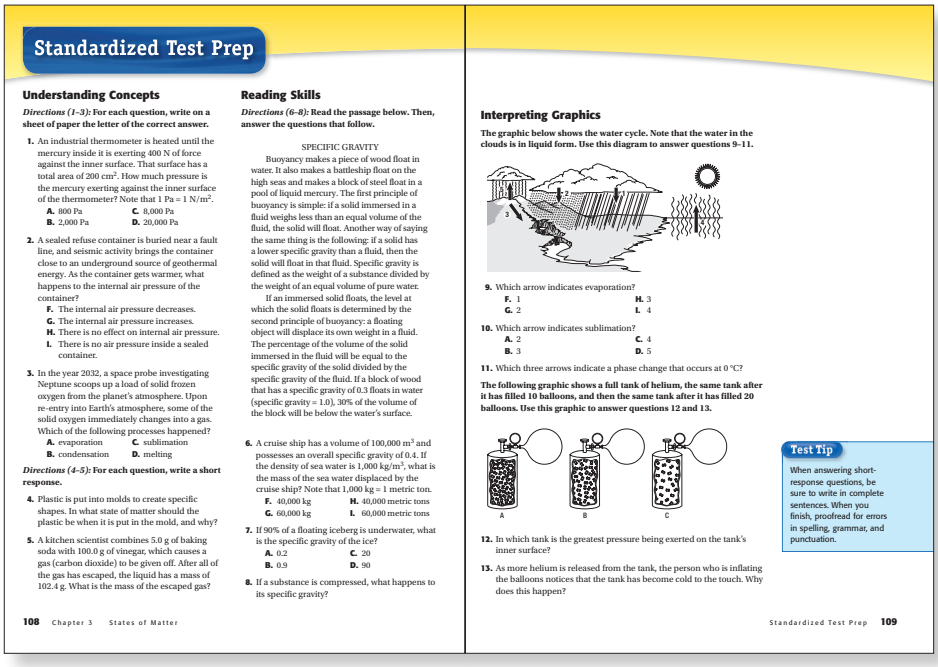
Interactive Reader is a full adapted read of each chapter and makes content from the Student Edition accessible to struggling readers. Reading strategies, directed reading questions, and interactive illustrations are provided to help develop students' reading skills.

Differentiated datasheets, chapter tests, and **worksheets** are available online so all your students can study the same lesson, but work at their own level.



Preparing All Students for Success

Standardized Test Prep provides practice and prepares students for high-stakes testing. Students develop their test-taking skills by answering questions that relate to understanding concepts, reading skills, and interpreting graphics.



Standardized Test Prep

Understanding Concepts

Directions (1–3): **For each question, write on a sheet of paper the letter of the correct answer.**

1. An industrial thermometer is heated until the mercury inside it is exerting 400 N of force against the inner surface. That surface has a total area of 200 cm^2. How much pressure is the mercury exerting against the inner surface of the thermometer? Note that 1 Pa = 1 N/m^2.
A. 800 Pa **C.** 8,000 Pa
B. 2,000 Pa **D.** 20,000 Pa

2. A sealed refuse container is buried near a fault line, and seismic activity brings the container close to an underground source of geothermal energy. As the container gets warmer, what happens to the internal air pressure of the container?
F. The internal air pressure decreases.
G. The internal air pressure increases.
H. There is no effect on internal air pressure.
I. There is no air pressure inside a sealed container.

3. In the year 2032, a space probe investigating Neptune scoops up a load of solid frozen oxygen from the planet's atmosphere. Upon re-entry into Earth's atmosphere, some of the solid oxygen immediately changes into a gas. Which of the following processes happened?
A. evaporation **C.** sublimation
B. condensation **D.** melting

Directions (4–5): **For each question, write a short response.**

4. Plastic is put into molds to create specific shapes. In what state of matter should the plastic be when it is put in the mold, and why?

5. A kitchen scientist combines 5.0 g of baking soda with 100.0 g of vinegar, which causes a gas (carbon dioxide) to be given off. After all of the gas has escaped, the liquid has a mass of 102.4 g. What is the mass of the escaped gas?

Reading Skills

Directions (6–8): **Read the passage below. Then, answer the questions that follow.**

SPECIFIC GRAVITY

Buoyancy makes a piece of wood float in water. It also makes a battleship float on the high seas and makes a block of steel float in a pool of liquid mercury. The first principle of buoyancy is simple: if a solid immersed in a fluid weighs less than an equal volume of the fluid, the solid will float. Another way of saying the same thing is the following: if a solid has a lower specific gravity than a fluid, then the solid will float in that fluid. Specific gravity is defined as the weight of a substance divided by the weight of an equal volume of pure water.

If an immersed solid floats, the level at which the solid floats is determined by the second principle of buoyancy: a floating object will displace its own weight in a fluid. The percentage of the volume of the solid immersed in the fluid will be equal to the specific gravity of the solid divided by the specific gravity of the fluid. If a block of wood that has a specific gravity of 0.3 floats in water (specific gravity = 1.0), 30% of the volume of the block will be below the water's surface.

6. A cruise ship has a volume of 100,000 m^3 and possesses an overall specific gravity of 0.4. If the density of sea water is 1,000 kg/m^3, what is the mass of the sea water displaced by the cruise ship? Note that 1,000 kg = 1 metric ton.
F. 40,000 kg **H.** 40,000 metric tons
G. 60,000 kg **I.** 60,000 metric tons

7. If 90% of a floating iceberg is underwater, what is the specific gravity of the ice?
A. 0.2 **C.** 20
B. 0.9 **D.** 90

8. If a substance is compressed, what happens to its specific gravity?

Interpreting Graphics

The graphic below shows the water cycle. Note that the water in the clouds is in liquid form. Use this diagram to answer questions 9–11.

9. Which arrow indicates evaporation?
F. 1 **H.** 3
G. 2 **I.** 4

10. Which arrow indicates sublimation?
A. 2 **C.** 4
B. 3 **D.** 5

11. Which three arrows indicate a phase change that occurs at 0 °C?

The following graphic shows a full tank of helium, the same tank after it has filled 10 balloons, and then the same tank after it has filled 20 balloons. Use this graphic to answer questions 12 and 13.

12. In which tank is the greatest pressure being exerted on the tank's inner surface?

13. As more helium is released from the tank, the person who is inflating the balloons notices that the tank has become cold to the touch. Why does this happen?

Test Tip

When answering short-response questions, be sure to write in complete sentences. When you finish, proofread for errors in spelling, grammar, and punctuation.

Technology That Enhances Instruction

Preview the Interactive Online Edition

FROM THE TEXTBOOK, CHAPTER 12: FORCES

While browsing this chapter, note the following special features that make Holt McDougal™ Interactive Online Edition much more than just an online textbook:

- Pop-up glossary terms, complete with audio pronunciation
- MP3 audio reading of the entire text, available for play or download
- Point-of-use, clickable resources including worksheets and study guide pages and more . . .

STUDENT RESOURCES AND eACTIVITIES TABS

Organized in expandable menus for each chapter, students have easy access to a host of materials including:

- **Visual Concepts**
- **Super Summary**
- **Interactive Concept Maps**
- **Virtual Investigations**
- Audio files for playback and download (organized by section)
- Self-assessment questions

TEACHER RESOURCES TAB

Everything is available here, including:

- All printable and editable **Chapter Resource Files**—including **Skills Worksheets**, **Lab Datasheets**, and **Assessments**
- Transparency images
- Spanish resources

To register for your online preview, go to **preview.hrw.com** and use the sample word **SCIENCE08**

Program Components

Student Edition

Teacher's Edition

Interactive Online Edition

Holt Science Spectrum Interactive Reader

TECHNOLOGY

Interactive Online Edition

Chapter Resources

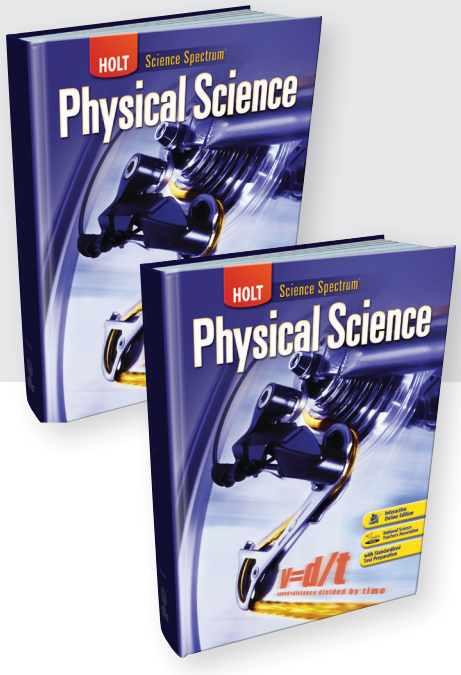
Online Transparencies

Student Edition Audio, both English and Spanish

Visual Concepts (Shockwave® required)

Virtual Investigations (Adobe Flash® required)

Lab Videos (QuickTime® Plugin required)



TEACHING RESOURCES

Chapter Resources

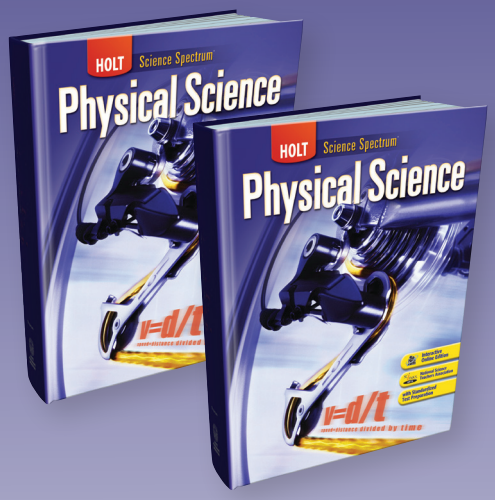
- Science Skills
- Math Skills
- Concept Review
- Cross-Disciplinary Connections
- Datasheets for In-Text Labs
- Skills Practice Labs
- CBL Probeware Labs
- Chapter Tests A and B
- Pretest
- Quizzes
- Standardized Test Practice with Guided Reading Development
- Lab Notes and Answers
- Answer Key for Skills Worksheets, Assessments, and Activities
- Teaching Transparency List

Math Skills Workbook

Study Guide

Teaching Transparencies

Holt Science Laboratory Manager's Professional Reference



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