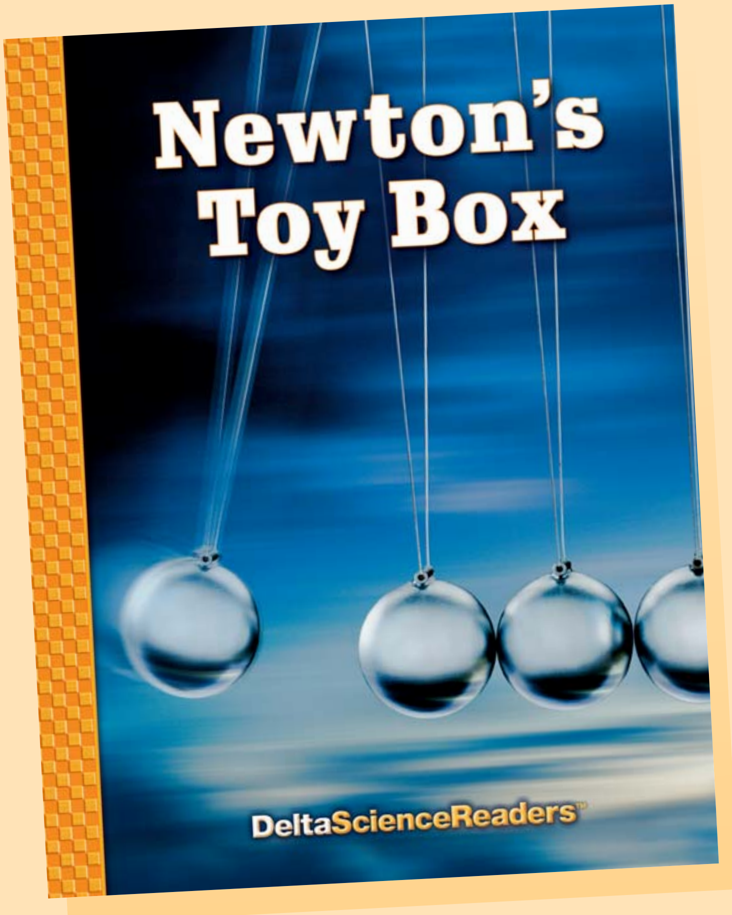
Delta Science Reader *Newton's Toy Box*
Teacher's Guide



In the Delta Science Reader ***Newton's Toy Box,*** students delve into the basic physics of motion. They find out how motion is described in terms of distance, direction, speed, force, mass, velocity, and acceleration. They discover the effects of friction and gravity on objects and read about conservation of momentum. Newton's laws of motion are explained and illustrated so that students can comprehend how and why objects move or do not move. Students also investigate the relationship between force, energy, power, and work and then explore machines, the devices that make work easier. Finally, students are introduced to Sir Isaac Newton and find out how satellites are placed in orbit and remain there.

DELTA SCIENCE READERS for grades 6–8 are content-rich, 24-page informational texts that present key science concepts and vocabulary. They cover important science topics in an accessible, engaging format.

TEACHER'S GUIDES for Delta Science Readers for grades 6–8 contain general background information for linking science and literacy, assessment, and including all learners, as well as a comprehensive teaching plan. The teaching plan features three-step lessons and spotlight panels on science, literacy, and meeting individual needs.

Contents

INTRODUCTION

Delta Science Readers for grades 6–8 are content-rich, 24-page informational texts. Based on key science standards for the topic, they are used in conjunction with hands-on kits or as stand-alone texts.

As students reach middle school, their reading abilities and knowledge of literacy skills and strategies greatly affect their success in understanding informational text. Middle school readers often need guidance in reading for information, especially as the content load of the text increases and becomes more complex. This guide provides the middle school teacher with both science and literacy support to help students learn.

Science and Literacy

Delta Science Readers are outstanding resources for building both science knowledge and literacy skills and strategies. Students interacting with informational text are exploring language fully, exercising all four aspects of literacy: reading, writing, speaking, and listening.

Reading Informational Text

Reading to gain information is markedly different from reading for literary experience or to perform a task. Informational text is often read nonlinearly, or selectively. From section to section, the difficulty level, concentration of new vocabulary, structural pattern, and unfamiliarity of content may vary. Use the following guidelines to help your students get the most out of reading nonfiction text.

Prereading. Help students anticipate content and predict learning outcomes before they begin to read. Always preview informational text with students so that they can develop a focused purpose for reading and be able to answer the question, "Why am I reading this?"

Reading Strategically. A number of reading strategies support the comprehension of science text, in part because of the strong relationship between science and reading comprehension skills. The following comprehension skills are common to both reading and science:

- Identify main ideas and supporting details
- Compare and contrast
- Relate cause and effect
- Trace a sequence of events
- Draw conclusions based on evidence
- Demonstrate critical thinking
- Generate questions
- Summarize information
- Interpret graphics
- Recognize patterns and relationships
- Make predictions

Some of these skills are applied in the process of extracting and processing information. Others are applied in more demanding ways as students evaluate, analyze, interpret, and synthesize ideas.

Monitoring Comprehension. Help students read actively. Active readers think about the organization and presentation of information and monitor their own comprehension. Provide these tips: reread difficult passages; vary the pace of reading; stop and think about a passage; ask questions; think aloud while reading; take notes; make a prediction about what will come next; or paraphrase what has been read. Also, some students can process and share information better when paired with a reading partner.

Using Graphic Organizers. Graphic organizers are diagrams that show the relationships among ideas. Unlike traditional outlines, graphic organizers are visual representations. They show, rather than tell about, associations among important facts and supporting details. Encourage students to create their own graphic organizers. The most effective ones are those generated by students themselves as they interact with information. Useful formats include the KWL chart (see p. T1), concept web, T-chart, Venn diagram, flowchart, and cycle chart.

Keeping Science Notebooks. Responding to informational text in writing promotes higher levels of understanding. Students should use their notebooks for all writing related to the topic. This can include graphic organizers, vocabulary lists, predictions, questions, observations, labeled illustrations and diagrams, personal discoveries, activity sheets, and note taking.

Building Science Vocabulary

Studying science involves learning specialized vocabulary terms. It may also mean relearning familiar words that have different meanings in science. Help students acquire new science vocabulary through multiple activities. Examples include analyzing word parts, understanding word origins, identifying word families, crafting definitions in their own words, role-playing or illustrating definitions, connecting new words to known words, using context clues, and using science language as they write and talk about science topics.

Previewing Vocabulary. When previewing the boxed vocabulary words for each section, you may wish to focus on the terms most critical to your curriculum needs. You may also wish to have students work in pairs or in small groups to share their ideas about words and meanings.

It is important for students to keep written records of their growing science language in their science notebooks. You may begin this record during the vocabulary preview, using any of the following ideas or your own method:

- Have students sort the vocabulary words into lists of terms they know and don't know. As they read and learn, the "Know" list should grow and the "Don't Know" list should shrink.
- Ask a volunteer to read the words out loud so students can hear correct pronunciations.
- Group related words together in a chart.
- Identify words with familiar roots, prefixes, or suffixes.
- Note familiar words that have a special or different meaning in science.
- Let students select one vocabulary word they know and illustrate it or use it in an original sentence.

Reading and Vocabulary Growth. Support the natural link between science and literacy by making your science classroom a library as well as a laboratory. Make available other kinds of reading material about the topic in addition to the Delta Science Readers. Examples include nonfiction trade books, newspaper and journal articles, computer printouts from validated and reliable sources, textbooks, reference books such as almanacs and encyclopedias, posters, CD-ROMs, and so on. Seeing science concepts and vocabulary used in other contexts reinforces understanding.

*See the **Glossary** page, T24, for many additional suggestions on building vocabulary.*

Assessment Features

Students' knowledge and skills should be assessed in as many modalities as they are taught so that all students can show what they know. This Delta Science Reader teacher's guide offers a variety of tools and strategies for measuring student achievement throughout the learning process.

Preassessment Preassessments take place prior to learning and provide information on students' awareness and experience regarding the topics.

- **Access Prior Knowledge**—informal assessments of students' entry-level understanding.

Ongoing Assessment Ongoing, formative assessments are integrated into the daily teaching and learning process. They not only measure ongoing student progress but also provide insights for reshaping and improving instruction.

- **Read to Understand Questions**—self-assessments or more formal evaluations of student mastery of key concepts. Suggested answers are provided.
- **Alternative Assessments**—additional choices, usually nonverbal, that provide other ways for students to demonstrate competencies.
- **Meeting Individual Needs**—teaching ideas that serve as assessments for students who have difficulty communicating fluently.
- **Answers to Caption Questions**—self-assessments related to student interpretation of graphic elements.
- **Notebooks**—student responses to science text and experiences that reveal growth in level of understanding and ability to organize ideas.

Postassessment Postassessments, or summative assessments, are opportunities for students to demonstrate what they have gained as a result of the learning experience.

- **Review and Reflect**—summative assessments that show the degree to which students can recognize patterns and understand relationships in the overall subject matter.
- **Writing Links**—writing assignments that require students to apply and communicate knowledge.
- **Cover to Cover**—opportunity for students to synthesize learning by comparing and contrasting front and back cover photographs.
- **Unit Test**—selected-response and short-answer questions (with answer key), provided with this teacher's guide, that measure comprehension of key science vocabulary and concepts.

Including All Learners

All students can be active participants in the scientific process and can become scientifically literate citizens. Further, all teachers can successfully guide students to learn and enjoy science. Making science content universally accessible may require implementing different instructional strategies and accommodating multiple intelligences. The guidelines listed below will help you meet the challenges of your diverse classroom.

Hands-on Science

The science classroom is an ideal environment for diverse learners because of its reliance on hands-on exploration of the world. Research has shown that all students are highly motivated to learn science when actively engaged in hands-on activities. Hands-on investigations are therefore an essential component of science education. Hands-on, inquiry-based science helps extend the reach of instruction to all students while enhancing and reinforcing student learning.

English Language Learners

When reading informational science text, language students are confronted with the challenge of learning content while becoming proficient in English. They may have the cognitive ability to perform in class and understand scientific meanings, but they may be unable to communicate, by reading, writing, speaking, or even listening, with proficiency and confidence. Using effective strategies, teachers can make content more accessible while language learners improve their English.

- Reinforce reader content with hands-on activities.
- Simplify vocabulary, not content.
- Allow multiple opportunities to practice new vocabulary.
- Present information orally and visually.
- Allow ELLs to demonstrate science learning nonverbally.
- Assess science comprehension, not English fluency.
- Promote a classroom environment in which students are comfortable sharing ideas and taking risks.

Learners with Special Needs

Individual student needs, abilities, and disabilities vary widely, and the accommodations appropriate for each classroom will be unique. Begin with a student's individual educational plan (IEP). Tailor the presentation, classroom setup, teaching strategy, and materials to ensure student safety and to enable each student to participate as fully as possible.

- Present instruction in the context of real-world situations.
- Pair students who have difficulty reading with friends who read fluently.
- Allow extra time for completing activities.
- Assign one task at a time and give instructions in different ways.
- Introduce new vocabulary in different, meaningful ways.
- Review material more often.
- Repeat other students' comments and questions for everyone to hear clearly.

Advanced Learners

Advanced learners benefit from meaningful assignments that extend and enrich their knowledge of science. Encourage students who readily grasp the basics of science concepts and processes to deepen their explorations. Students performing above grade level can cultivate high levels of science thinking through further research, investigation, or other guided or independent projects.

- Provide enrichment opportunities for students who can and wish to work on independent projects.
- Ask questions that encourage creative or imaginative answers.
- Model thinking that leads to problem solving, synthesizing, analyzing, and decision making.
- Make available more sophisticated resources for exploring the topic.
- Invite students to present their research to the class in a format of their choosing.

See the ***Meeting Individual Needs*** *spotlight panels throughout this guide for specific suggestions for including English Language Learners, learners with special needs, and advanced learners.*

About the Teaching Plan

The format and content of the three-step lesson plans and spotlight panels for each ***Think About . . .*** section in the student book are described below. Use the suggestions and strategies as appropriate for your teaching style and the needs of your students.

Three-Step Lesson Plan

The lesson plan for each section begins with a list of **learning objectives.** The final objective in each list highlights one reading skill that promotes science comprehension.

1 Before Reading Before-reading strategies set the stage for reading each section. Prereading efforts are particularly important with informational text because the reader will encounter new and complex ideas, different text forms and structures, and unfamiliar vocabulary. Make the process less daunting by accessing prior knowledge and previewing the section.

Access Prior Knowledge. These discussion prompts help you engage and motivate students by linking the main ideas students will read about to their existing knowledge and experiences. In some cases, it may be appropriate to identify and address common misconceptions about the topic at this point.

Preview the Section. This is a "walk-through" of the section content and vocabulary. Point out or discuss the boxed Read to Understand questions and vocabulary words. These indicate the main topics and key terms covered in the section. Also, look together at the section title and subheads. Based on the preview, students can generate questions, make predictions, and set a purpose for reading this section.

2 Guide the Learning Help students interact with the text, monitor comprehension, and integrate new ideas with existing knowledge as they read. A variety of grouping strategies is suggested so that students may benefit from collaborative learning.

Discuss and Explore. These questions elicit student responses that demonstrate comprehension of facts and concepts. The science and literacy skills developed during reading include

- relate cause and effect
- identify the main idea and supporting details
- trace a sequence of events
- compare and contrast
- describe
- predict

Critical Thinking. These questions challenge students to dig deeper and exercise higher-order thinking skills, such as

- infer
- draw conclusions
- interpret
- summarize
- generate questions

3 Assess After-reading assessments for each *Think About . . .* section include

Read to Understand Answers. Sample answers to the Read to Understand questions are provided. The questions can function either as informal self-assessments for students or as part of an ongoing written or oral assessment of student progress.

Alternative Assessment. These assessment opportunities, such as hands-on demonstrations or visual presentations, accommodate multiple learning and communication modes.

This teacher's guide offers opportunities for multiple measures of student progress. See ***Assessment Features,*** *p. Tiii, for additional tools.*

Spotlight Panels

Special feature boxes appear on each page to provide additional support.

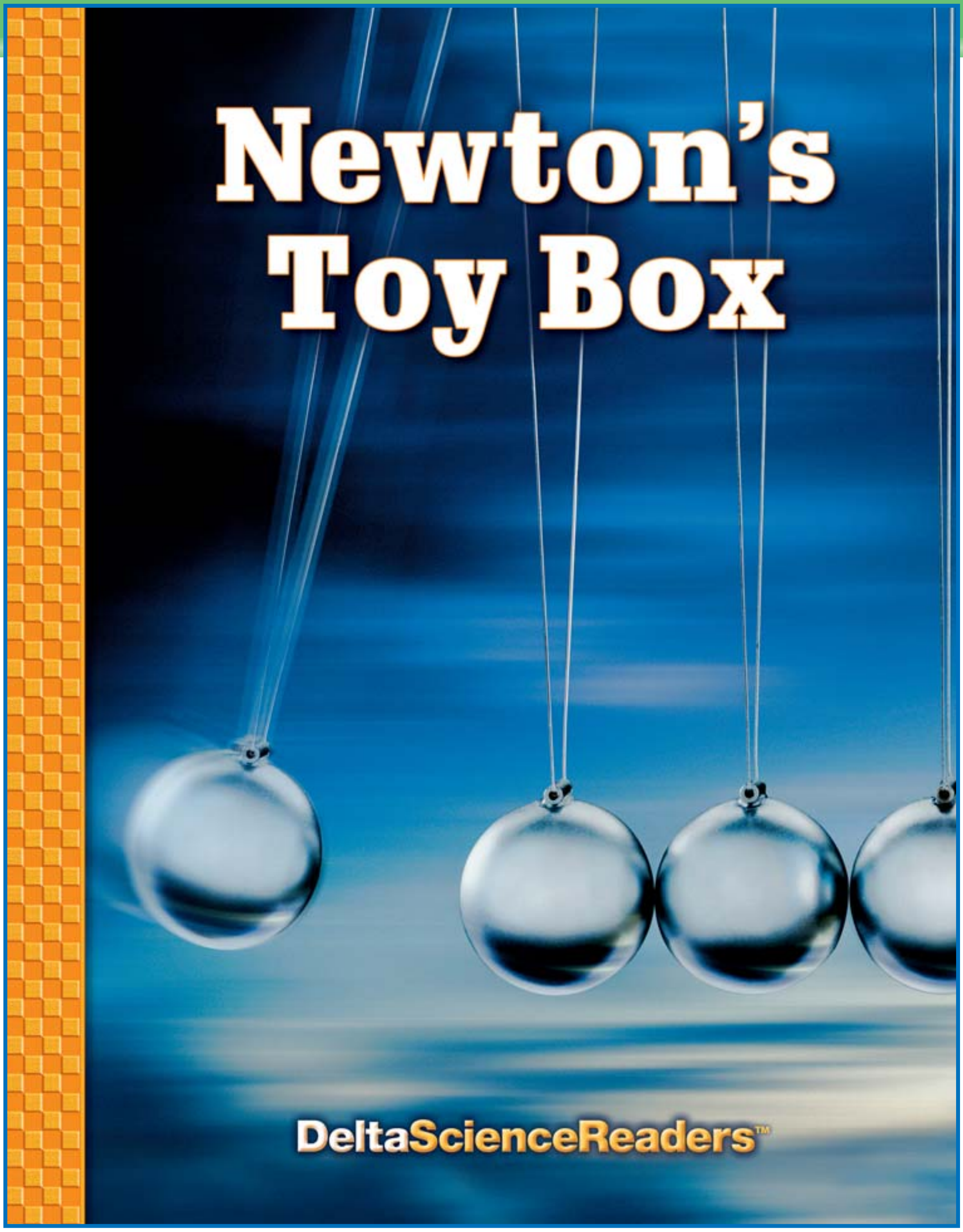
Science. Additional science background information, historical perspectives, and facts and figures of interest that support science instruction and can be shared with students as appropriate.

Literacy. Ideas for strengthening literacy skills in the areas of reading comprehension, vocabulary, notebooking, organizing ideas, and using the visuals.

Meeting Individual Needs. Suggestions for making science content and vocabulary accessible to English Language Learners and students with special needs and for including and challenging advanced learners.

Teaching pages for ***People in Science*** *and* ***Did You Know?*** *also offer suggestions for activating prior knowledge and building comprehension and include science spotlight panels. The Glossary page provides many helpful vocabulary-building strategies.*

TEACHING *Newton's Toy Box*



The Delta Science Reader ***Newton's Toy Box*** presents the key science concepts related to forces and motion; Newton's laws of motion; work, energy, and power; and simple machines. The book provides opportunities for students to engage in science inquiry by applying literacy skills and strategies to nonfiction text. Students explore science as they develop informational literacy.

Build Background

Front Cover. Access students' prior knowledge of forces and motion by displaying the cover and discussing the title. *Has anyone ever seen a toy that looks like this?* (Answers will vary. The toy is called Newton's Cradle.) *What parts of this toy do you think are moving?* (the ball on the left) *Why do you think so?* (The picture is blurred, which indicates motion. The ball could not just hang in midair at an angle without falling so it must be moving.) *What do you think causes the motion?* (Accept all answers.) *Who is the "Newton" referred to in the title?* (Sir Isaac Newton, a famous scientist who lived about 300 years ago)

Encourage students to share what they know about forces and motion from their personal experiences and hands-on explorations in science. If possible, show students an actual Newton's Cradle, or engage them with other simple, nonmechanical toys and games that demonstrate basic principles of motion, such as a spring toy, a seesaw, or a tug-of-war match. Stimulate discussion with questions such as these: *What causes the object to move? Why do moving objects eventually stop moving if no one is pushing or pulling them?*

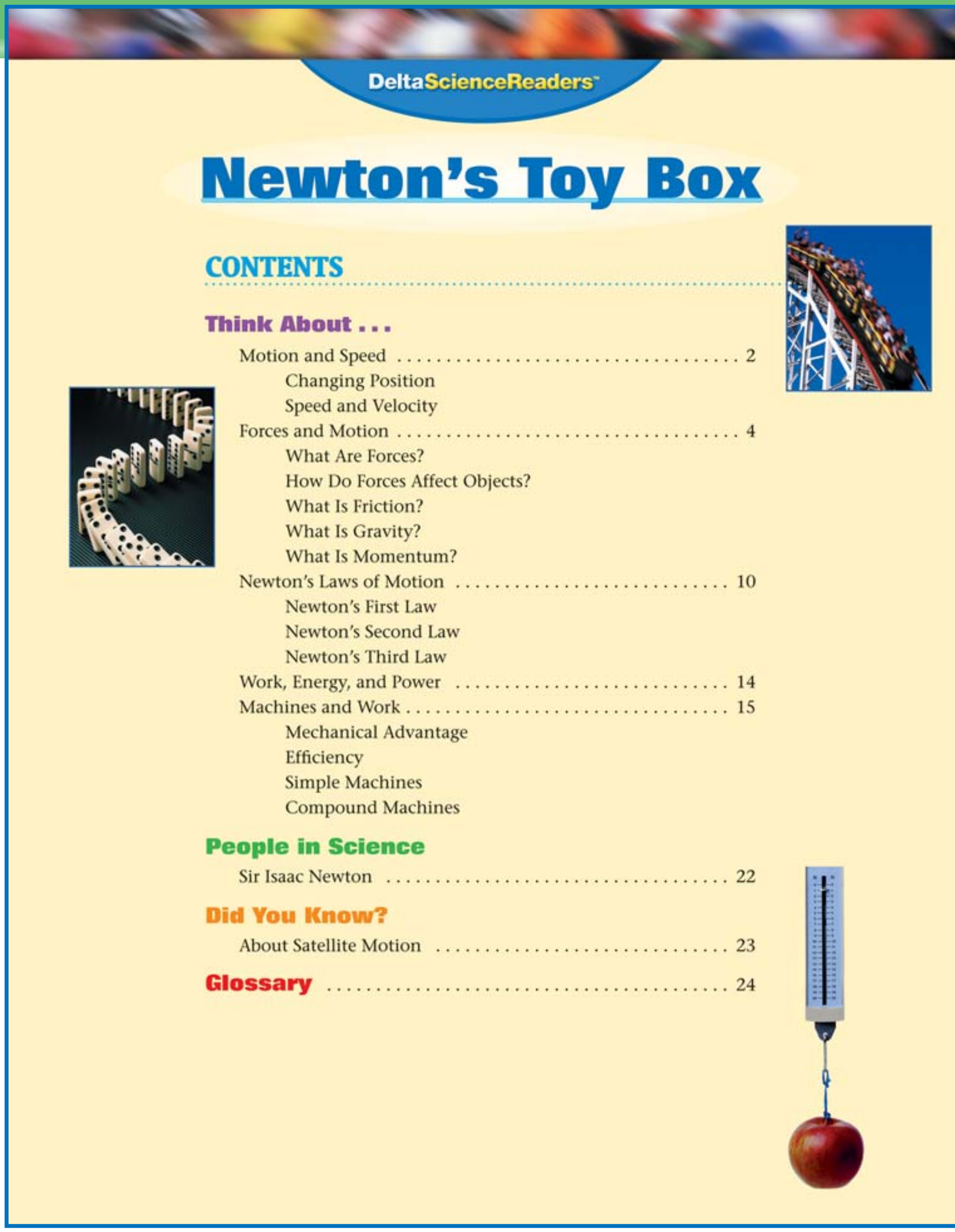
Such discussions help students make connections between what they already know and new information that will be presented in the text.

Based on the title and cover, have students predict what they might learn about in this book.

Preview the Book

In a preview, students scan the book quickly to see the structure and to find the main topics and most important text features. Have students preview *Newton's Toy Box* before reading.

Roadmap for Reading. Tell students that previewing is like looking at a map before taking a trip. It helps us know where we are going! Using a preview to anticipate content increases student interest in the material to be studied. For that reason, a preview is a vital part of reading for information, or nonfiction reading. Use the preview to activate prior knowledge, make predictions about what the text will cover, and set a purpose for reading.


DeltaScienceReaders™

Newton's Toy Box

CONTENTS

Table of Contents. Begin the preview with the table of contents. Think of the table of contents as an outline of the book. It lists the different parts of the book and the topics covered in each part. Page numbers are given for the main section headings. After students have skimmed the table of contents, ask if they have ever studied any of these topics before. Look at the photographs on the contents page. Can students guess where in the book they might find out about the objects pictured?

Text Features. Next, have students "walk through" the book. Ask them to look at the headings, subheadings, and graphics (photographs, diagrams, captions, illustrations, labels, graphs, and tables) and tell why they are helpful. Focus their attention on organizational features, such as the boxed Read to Understand questions, boxed vocabulary lists, boldface words, and Glossary.

For each new feature students identify, have them ask questions: Why are these [*boxes*] here? What are the purposes of [*map keys*]? How do these [*boldface words*] help us understand the topic? What if the book did not have [*figure numbers*]?

Start a KWL Chart

Have students make a four-column KWL chart in their science notebooks. Based on the book's title and their preview, have them fill in the first two columns—What I Know (K) and What I Want to Know (W). Have students fill in the third column, What I Learned (L), as they work through the book. After students have finished reading about each topic, they can fill in the last column with questions they still have about the topic. Generating questions is an important critical thinking skill for responding to text and motivating more investigation.

Conceptual Framework

Help students make meaning of the content covered in *Newton's Toy Box* by building a conceptual framework—a theme around which students can organize ideas and information. For this topic, such a framework might be **Forces act on objects to cause or to stop motion.** All around us, objects of different sizes are moving in different ways, for different reasons, at different speeds, and in different directions.

Begin by discussing students' common experiences of observing objects moving (changing position) in their everyday surroundings and the natural world. For example, what objects did they observe moving on the way to school or to class that day? For each suggestion, have students describe evidence that a force caused something to move during a specified period of time. Ask what object moved, how far it moved, and what caused it to move. As students read, they can relate their learning about Newton's laws of motion to this framework. Help students become thoughtful observers of the world.

OBJECTIVES

(pages 2–3)

- Measure changes in position by distance and displacement.
- Calculate average speed.
- Distinguish between speed and velocity.
- Use reading strategies such as identifying the main idea to achieve science comprehension.

1 Before Reading

Access Prior Knowledge

Ask students questions to elicit their ideas about motion, distance, direction, and speed. Place a ball on the floor. Roll it across the front of the class. *Why did the ball start moving? What changes occur as the ball moves? How would you describe its motion?*

ADDRESSING MISCONCEPTIONS

Students may think that speed and velocity are the same and that displacement and distance are the same. Demonstrate that knowing the starting point of an object and the distance or speed that it travels does not allow us to find out where the object ends up. Ask a student near the center of the class to stand. Ask the class where that student would be if he or she traveled 3 m. (The student could end up anywhere along the path of a circle with a 3-m radius.) They need to know the direction of motion to solve the problem.

Preview the Section

Use the Read to Understand questions to set a purpose for reading (answers on p. T3). Preview the Vocabulary words using one of the methods described on p. Tiii. Remind students that these important words appear in boldface type in the text and are defined in the Glossary. (See p. T24 for vocabulary-building strategies.)

Think About . . .

Motion and Speed

▶ **Figure 1** We can tell this horse is moving because we see it pass by objects that are not moving—fence posts. The fence posts are our reference points.

READ TO UNDERSTAND

- How are position and motion related?
- How can we describe the motion of an object?
- What is speed, and how is speed related to velocity?

VOCABULARY

motion
position
reference point
distance
displacement
speed
average speed
velocity

Changing Position

Motion is the process of changing from one **position,** or place, to another. How do we know when something is moving? We often compare its position to the position of nearby objects that are stationary, or not moving. These other objects are called **reference points.** An object is moving if its position changes compared to a reference point. When you ride a bus, you can tell that you are moving because you pass stationary objects, such as buildings or trees. These objects are your reference points. When you are standing still, you can see that a bird flying overhead is moving because it gets farther and farther away from you. In this example, you are the reference point.

Changes in an object's motion and position can be measured in various ways. **Distance** is the measure of how far it is from one point to another. In the United States, distance is often measured in inches, feet, or miles. In science, we use centimeters, meters, and kilometers, the basic units of distance or length in the International System of Units (SI). An insect might crawl a distance of 30 centimeters (about 12 inches) along a branch. A student might walk a distance of 6 meters (about 20 feet) in the school lunch line. A runner might run a distance of 10 kilometers (about 6 miles) in a race.

2

MEETING INDIVIDUAL NEEDS

English Language Learners ELL students may be more familiar with the International System of Units (SI) than with the Customary or English system used in the United States. Their proficiency with SI measurements will be an advantage in science class and may inspire other students.

Encourage ELL students to use their science notebooks regularly for taking notes in English or in their first language. They also can use their science notebooks to begin a personal glossary of science terms and other new words.

Learners with Special Needs Help students visualize the runner example on p. 3 (first paragraph) by drawing a 3:4:5 triangle on the board. Label the compass directions. Trace how the runner traveled 7 km (3 km north and 4 km east) but was displaced only 5 km northeast. Have students practice with other examples.

Sometimes we need to know more than simply the distance an object traveled. **Displacement** describes both how far an object moved from its original position and in what direction it moved. For example, a runner following a path through a park might travel 3 kilometers north, turn right, and travel 4 kilometers east. The total distance the runner traveled is 7 kilometers. But her final position is actually only 5 kilometers northeast of her starting point. So the runner's displacement is 5 kilometers northeast.

Speed and Velocity

Sometimes we describe an object's motion in terms of its **speed,** or how fast it changes position. Speed compares the distance an object travels with the time it takes to travel that distance. So speed is a rate, a comparison of two quantities that have different units of measure. Speed is described in units of distance divided by units of time, such as meters per second (m/s) or kilometers per hour (km/h). For example, cheetahs can run at speeds of more than 30 m/s.

To calculate speed, we divide the distance an object travels by the time it takes to travel that distance. For example, a horse may travel 180 meters in 60 seconds. The horse's speed is calculated below:

$$\text{speed} = \frac{\text{distance}}{\text{time}} = \frac{180 \text{ m}}{60 \text{ s}} = 3 \text{ m/s}$$

So we know the horse moves at a speed of 3 meters per second (m/s).

Objects do not always move at one steady speed, however. Imagine a family traveling in a car from one place to another (Figure 2). The first part of the trip is on a highway. The car travels 95 kilometers (about 59 miles) in 1 hour. During the next 3 hours, the family first gets stuck in a traffic jam, then makes a rest stop, and finally finishes the drive. The car travels 115 km (about 71 miles) in these 3 hours. How can we describe the car's speed during the whole trip? Since we know the total distance and the total time, we can calculate the car's **average speed.**

$$\text{average speed} = \frac{\text{total distance}}{\text{total time}}$$

$$\text{total distance} = 95 \text{ km} + 115 \text{ km} = 210 \text{ km}$$

$$\text{total time} = 1 \text{ h} + 3 \text{ h} = 4 \text{ h}$$

$$\text{average speed} = \frac{210 \text{ km}}{4 \text{ h}} = 52.5 \text{ km/h}$$

▲ **Figure 2** This distance-time graph shows changes in the motion of a car as a family took a trip. When was the car stopped?

Speed describes how fast an object is moving, but it does not describe the object's direction. **Velocity** describes both an object's speed *and* its direction. Suppose a bicyclist is traveling north at a speed of 15 km/h. At that moment, the bicyclist's velocity is 15 km/h north. Any change in the bicyclist's speed *or* direction changes his velocity.

2 Guide the Learning

Discuss and Explore

Main Idea Have students reread Changing Position and state the main idea, or most important point, of the three paragraphs in their own words. (Changes in position can be described in terms of whether an object is moving, the distance it moves, and how far it ends up from where it starts.)

Critical Thinking

Infer Ask students how a vehicle could, at the same time, have a constant speed but a changing velocity. (The vehicle's direction must be changing.)

Answer to Caption Question

Figure 2. The car stopped between hours 2 and 3, where the slope = 0. (The slope is the upward or downward slant.)

3 Assess

Read to Understand Answers

How are position and motion related? Motion is the process of changing position.

How can we describe the motion of an object? Motion can be described in terms of distance, displacement, speed, and velocity.

What is speed, and how is speed related to velocity? Speed is how fast an object changes position. Velocity describes both an object's speed and its direction.

Alternative Assessment

A student runs one lap around the track. She completes the 400-meter lap in 2 minutes. Describe the distance she traveled, her speed, displacement, and velocity during this lap. (Distance traveled is 400 meters, displacement is 0, average speed is 200 m/min, and velocity constantly changes as she travels around the curves.)

SCIENCE

Facts and Figures Students may need extra practice interpreting and creating time-distance graphs. Remind students that time intervals are plotted on the *x*-axis (horizontal) and distance intervals are plotted on the *y*-axis (vertical). Explain how to plot equal intervals (such as seconds and meters) on the axes, how to label units, and how to plot and interpret the meaning of data points. Let students practice recording motion on a time-distance graph. Choose one student to travel the perimeter of the classroom or schoolyard at a varying pace. Have a timekeeper with a stopwatch call out 5-second intervals. Whenever a time is called, the walker drops a marker. Students measure the distances between markers to learn, and then plot, how far the walker traveled in each 5-second time period. A straight diagonal line would indicate a steady pace; a flat line, no movement; and a zigzag line, a varying pace.