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At the Movies

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Literacy Overview

Reading Selections

• Fantasy Movies (history article)
• Tricks for Sound (science article)
• Creating Visual Effects (science article)
• IMAX® to the MAX (science article)

COMMON CORE STATE STANDARDS FOR ENGLISH LANGUAGE ARTS

CC.4.RInfo.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.

CC.4.RInfo.2 Determine the main idea of a text and explain how it is supported by key details; summarize the text.

CC.4.RInfo.3 Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.

CC.4.RInfo.5 Describe the overall structure (e.g., chronology, comparison, cause/effect, problem/solution) of events, ideas, concepts, or information in a text or part of a text.

CC.4.RInfo.7 Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.

CC.4.RInfo.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.

Writing Standards (page 17)

CONTENT GOAL

Students will read four selections in *At the Movies*. They will learn how moviemakers use different forms of energy to create visual and sound effects.

COMPREHENSION GOAL

Remind students that as thinking-intensive readers they must listen to their inner voice to monitor and repair comprehension as they read. Find opportunities to model and teach active thinking strategies to help students access content. You may want to focus on the following strategies for *At the Movies*.

• **Activate and Connect to Background Knowledge**: Readers use what they know or have experienced to help them understand new information. However, they must be prepared to reverse any misconceptions in light of new learning or new evidence.

• **Infer and Visualize**: A writer doesn’t always tell everything. Readers have to use their background knowledge and pay attention to the text and picture clues to make inferences and visualize to construct meaning.
ACTIVATE & BUILD BACKGROUND

Draw the graphic organizer shown above. Ask: What are some special visual and sound effects you see and hear in movies? Write students’ responses in the graphic organizer.

Model for students by thinking aloud. You might say something similar to the following: I saw a movie that was in 3-D. We got special glasses to wear during the movie. As I watched, it looked like the characters and scenery were right in front of me and moving straight toward me. I even ducked a few times and gave out a little yell!

Explain that all of the incredible visual and sound effects used in movies are made possible because energy can change from one form to another. You might say: Light and sound are different forms of energy. Moviemakers change light and sound in different ways to create exciting visual and sound effects that make their movies come to life.

Ask students to Turn and Talk about different special effects they have experienced in movies and what they think they know about these special effects.

Students can then Share what they know or what they have seen or learned about visual and sound effects in the movies.

You may want to return to the graphic organizer to add more information after students read each selection.

BUILD SCIENCE BACKGROUND

Pages 4–6 of this teacher’s guide address how certain science concepts relate to each selection in At the Movies. This information will provide you with science background knowledge as you plan your teaching for this book.

Help students access background knowledge related to the science concepts. Support the concepts of optical illusion and amplify in ways that are familiar to your students.

• optical illusion: Show pictures of different optical illusions that you can find on the Internet. Have students describe what they see in each and explain what they think is happening.

• amplify: Ask students how they make their voices louder. Tap a tabletop softly and ask students how you could make the sound louder. Explain that making sound louder is amplifying it.
Science concepts are a critical part of each selection in *At the Movies*. These pages will help you build content knowledge so that you may more effectively have discussions with students as they read each selection in the book.

The following big idea science concepts apply to several selections in the book.

- **An optical illusion** (student book, pp. 5, 21) is something that appears different from what actually exists. Many optical illusions use light, patterns, and/or color to “trick” our brains into seeing something different from what is really there. Optical illusions work because your eyes see, but your brain perceives. Light enters your eyes and strikes the retinas at the back, which change the light to electrical impulses. These signals are sent to your brain by the optic nerve. Your brain interprets this sensory input based on past experiences, so you sometimes see what you expect to see instead of what really exists.

- **To amplify** (student book, pp. 11, 17) means to increase the strength of a signal. Sound is a form of energy that can be amplified, or made stronger. Sound travels in waves. The intensity of a sound is the amount of energy the sound wave has. You hear this intensity as loudness. The more energy a sound wave has, the louder the sound seems. The amplitude, or height, of a sound wave is a measure of the amount of energy in the wave. The greater the intensity of a sound, the greater the amplitude. The amplitude of a sound wave can be increased by giving it more energy, thereby making the sound more intense, or loud.

  Sound can be amplified in different ways. For example, beating a drum harder will make the sound louder. Using more energy to speak louder will amplify the sound of your voice. Sound can be amplified electronically, too.

Pages 5–6 in this teacher’s guide describe how the science concepts above relate to each selection. Additional science background information is given for each selection.
FANTASY MOVIES

Student Book, pp. 2–15
Teacher’s Guide, pp. 7–8

In this selection, students will learn about special techniques used in moviemaking that have developed over time, such as **optical illusion** (student book, p. 5) and **amplified** (student book, p. 11) sound.

Color films began appearing in the late 1800s and early 1900s. Some films were colored by painting individual frames by hand. Some were made by projecting the film through a filter to add certain colors of light. Others were made by layering color dyes on the film to block certain colors so only the correct color showed on the screen when light was passed through the film.

Both animated and live-action films use an optical illusion based on the principle of persistence of vision to bring the movies to life. Your eyes and brain keep a visual impression of an image for a fraction of a second. So when drawings or still photographs are shown in rapid succession—as movie frames are—the brain views them as smooth, continuous movement instead of individual images. More than 15 images per second are required for the brain to perceive this illusion. Modern movies are shown at 24 frames per second.

Computer-generated imagery (CGI) is a special effect used in many movies today whereby images are created by a computer using mathematical calculations. The process often starts by using a real three-dimensional model and then creating a matching computer model. Then an animator can tell the computer how the model should move. Animators often use concepts of physics to make the movements of the models look realistic and create lighting that matches live-action elements.

TRICKS FOR SOUND

Student Book, pp. 16–19
Teacher’s Guide, pp. 9–10

In this selection, students will learn how Foley artists add sound effects to movies. They will also learn that a microphone **amplifies** (student book, p. 17) these sounds.

It is important for Foley artists to understand acoustics so they can create realistic sounds to match what the audience sees in a movie. When movies are filmed, only the dialogue of people speaking is recorded so that the actors’ voices can be clearly understood without any background noise. All other sounds, such as shuffling papers on a desk, walking down the hallway, tires squealing, and cars crashing, are added later.

Many of the background sounds are created by using objects and movements very different from what people actually see on screen. For example, as described in the selection, crumpling cellophane may be used as the crackling of a fire. The artists use different techniques to create the right sounds at the right volume so the sounds seem real and viewers don’t notice that they were not recorded at the same time as the action seen on screen.

All movie sounds must be recorded by microphones. When sound waves reach a microphone, they strike a membrane in the microphone, causing the membrane to vibrate. These vibrations make an electromagnet in the microphone move back and forth, sending electrical impulses through a wire to a recorder, where they can be controlled and converted back to sound.
CREATING VISUAL EFFECTS

In this selection, students will learn about visual effects used in movies.

The movement we see in many forms of animation is actually an optical illusion (student book, p. 21). According to the principle of persistence of motion, the human brain will see the illusion of continuous movement when viewing frames of still images at a rate of more than 15 frames per second.

One early example of this principle is the zoetrope, which was invented in the 1830s. The zoetrope is a rotating drum with pictures showing a sequence of motion lining the inside perimeter, and slots along the outside at equal distances. When a viewer looks through the slots and spins the drum, the viewer will see the progression of motion of the pictures.

Today, some animated films use two-dimensional figures drawn on cels (transparent sheets of celluloid) in different stages of action. When the cels are shown in rapid succession, the figures on the cels appear to move. This same technique of stop-motion animation can be used with solid three-dimensional objects, puppets, or clay, as well as drawings. The objects are moved very slightly before each photograph is taken. When the frames are played back at the correct speed, the objects appear to move continuously, even though the action is composed of individual still images. The principle is the same as in a flip book.

IMAX® TO THE MAX

In this selection, students will learn how IMAX® technology was used in the film Avatar.

Light energy is important for making 3-D movies. Light waves vibrate on many different planes. Polarized light waves vibrate only on one plane. IMAX 3-D films use polarized light to create a 3-D effect.

Humans have stereoscopic vision, which means that each of our eyes has a slightly different view when we focus on an object. Our brain combines the images, allowing us to see depth between objects. IMAX 3-D movies are filmed using two lenses side by side, so each lens films a slightly different view. Each of the films is projected through a different polarized filter so that only light vibrating on one particular plane passes through. Both images are projected on the IMAX screen at the same time. The glasses that we wear to watch a 3-D movie are polarized so that the right eye sees only what was filmed from the right camera and the left eye sees only what was filmed from the left camera. Our brain combines the images, causing us to see the movie in three-dimensional depth as if we were actually there instead of watching the scenes on a flat screen.

Besides light energy, sound energy also is important to IMAX movies. IMAX theaters are specially designed so that the sound reaches each seat equally, providing good sound quality regardless of where you are sitting in the theater. The specially designed speakers provide a larger range of sounds, so viewers not only hear but also feel the vibrations of higher and lower sounds. The theaters also are designed with effective soundproofing, so viewers are not disturbed by noises outside the theater.
Summary  “Fantasy Movies” is a history article that describes some of the special effects used in selected popular movies over the years and how these effects were created.

BUILD BACKGROUND FOR THE GENRE

Ask students to turn and talk and then share what they expect to see in a history article. Tell them that “Fantasy Movies” is a history article with the following elements:

- Events are organized and presented in the order in which they happened (chronological order).
- Information is based on real people and events.
- It tells about historic events in movie-making.

BUILD VOCABULARY & CONCEPTS

- optical illusion
- amplified

Remind students that Using Context Clues is a strategy to infer the meaning of an unfamiliar word. They can “read around” the word, or read a few sentences before and after it, to make meaning from the context. Remind them to look at the photographs, too.

Another strategy to try is Using Graphic Organizer Notes. Have students create a graphic organizer with four columns: Word, Inferred Meaning, Clue, and Sentence or Picture. Ask students to write optical illusion in the first column and turn and talk about what they infer it means. Then have them write the inferred meaning in the second column. In the third column, have them write the clue from the text that helped them infer the meaning. Ask them to write a sentence or draw a picture in the last column to show their understanding of the word’s meaning. Follow the same steps for the word amplified.

Point out other important words or terms in the selection, such as computer-generated imagery, fantastic, sepia, animators, and celluloid. Have students use context clues or graphic organizer notes to determine the meaning of these and any words or terms that might be challenging or unfamiliar.
**READ**

The content goal for *At the Movies* is for students to learn how moviemakers use different forms of energy to create visual and sound effects. Explain that “Fantasy Movies” tells about selected films over the past eight decades and how the moviemakers used special effects to create characters, scenes, sounds, and other elements in the movies. Point out the Read to find out statement at the top of page 2 in the student book: Read to find out how movie-making has changed over time.

Help students with the comprehension goal of accessing content by activating and connecting to background knowledge. Model the strategy by reading the text at the top of page 2 aloud. Then say: I've seen lots of movies with talking animals, dinosaurs, and other creatures that don't exist in real life. I know that they're made using special effects, but I don't know exactly how. I'll keep this in mind as I read, to help me understand.

Before students begin reading, say: As you read, think about what you already know about special effects in movies. Use that information to help you understand new information that you read in this article. You may need to revise your thinking based on new information.

**TURN & TALK**

Revisit the Read to find out statement. Have students turn and talk to tell how moviemaking has changed over time. (Possible responses: Moviemakers learned to film movies in color instead of only black and white, developed animation techniques so animated characters could appear along with live actors, learned to create elaborate and realistic sets, created robotic puppets [animatronics] to make creatures that don't really exist, developed sound effects and speakers to help people hear and feel sounds in movies, and used computer-generated imagery [CGI] and green screens to create complex scenes and characters.) To check understanding, have students turn and talk about the Check In question: What are some movie-making techniques that changed over time? What are some that haven't changed? (Possible response: Moviemakers can use CGI instead of using frame-by-frame animation or building animatronics or complicated, elaborate sets, but some moviemakers still use old techniques of stop-action photography or black-and-white film for some movies or scenes.)

**Describe Problems and Solutions** Point out that each section of the article describes a special effect. Model how to explain different special effects. Say: The creators of *The Wizard of Oz* solved the problem of showing viewers the transition from Kansas to Oz by changing from sepia to color. Ask: How did the creators of each of the movies use special effects to solve a problem? Have students turn and talk to explain the special effect used in each film. (Possible response: In *The Incredible Mr. Limpet*, the main character turns from a human into a fish. To show Henry as a fish, artists used frame-by-frame animation to show him as a fish with lips, eyes, glasses, and facial expressions that looked like Henry as a human.)

**Describe Chronology** Share that many articles have more than one text structure and that in addition to problem/solution this article also has a chronological text structure. Clarify that chronological order is the order in which things happened. History articles often have text features that show this order. Have student pairs page through the article and identify text features that tell them the chronology of the films. (headings with film titles and years) Ask: In what order do you think the special effects techniques described in the article were developed? (Possible response: color films, animation combined with live action, animatronics, surround sound, CGI)

**WRITE & ASSESS**

You may want to have students do a “quick write” to assess understanding. It’s always helpful to have students reflect on both the content of the selection and their thinking process.

- How do moviemakers use special effects to solve problems?
- What else does this article make you think of?
**Summary**  “Tricks for Sound” is a science article about how Foley artists use knowledge of sound energy and different techniques to create sound effects for movies.

**BUILD BACKGROUND FOR THE GENRE**

Ask students what they expect to see and read in a science article. Then tell them that “Tricks for Sound” is a science article with the following elements:

- It uses facts, details, examples, and evidence to present information about a science topic.
- Ideas and concepts are explained by pointing out problem/solution relationships.
- Facts and information are presented through photos, captions, and inset text.

**BUILD VOCABULARY & CONCEPTS**

Remind students that **Using Context Clues** is a strategy to infer the meaning of an unfamiliar word. They can “read around” the word, or read a few sentences before and after it, to make meaning from the context. Remind them to look at the photographs, too.

Another strategy to try is **Using Background Knowledge**. Have students turn and talk about what they think the word **acoustics** means. Then have them read the word in context. Foster a collaborative discussion to help the class co-construct the meaning of the word as their ideas emerge. Follow the same steps for the word **amplifies**.

Point out other important words in the selection, such as **engineer**, **technician**, and **mimicked**. Suggest that student pairs use context clues and background knowledge to determine meaning for these and any words that might be challenging or unfamiliar.
READ

The **content goal** for *At the Movies* is for students to learn how moviemakers use different forms of energy to create visual and sound effects. Share that “Tricks for Sound” explains how Foley artists use sound energy to create sound effects for movies. Point out the **Read to find out** statement at the top of page 16 in the student book: *Read to find out how movies get their special sounds.*

Help students with the **comprehension goal** of accessing content by activating and connecting to background knowledge. Model this strategy by reading the text and the caption on the bottom of page 17 aloud. Then say: *I know what horses’ hooves sound like, but I never imagined that when I hear horses running in a movie, the sound may be created by people using other objects. When I think of what a horse’s hoof looks like, I can see that a plunger stuffed with a rag resembles it in shape and size. That helps me understand how pounding the plunger on dirt would produce a sound like a horse’s hoof pounding the ground.*

Before students begin reading, say: *As you read, think about what you already know about how sounds are made. Use that information to help you understand new information that you read in this selection. But be prepared to revise your thinking based on new information.*

**TURN & TALK**

Revisit the **Read to find out** statement. Have students turn and talk about ways sound effects are created for movies. (Possible responses: Different objects are used to add sound effects to movies after they are recorded. Crumpling candy wrappers can sound like a crackling fireplace.) To check understanding, have students turn and talk about the **Check In** question: *What are some ways Foley artists create sound effects?* (Possible responses: Slapping leather gloves together can sound like the flapping of a bird’s wings. Fingers in a bowl of uncooked rice can sound like feet crunching dry grass.)

**Use Details and Examples** Remind students that the term “Foley artist” comes from the name of Jack Foley. Have students turn and talk about why. Suggest they look in the text for details and examples to support their response. Then have pairs share their responses with the class, and prompt several pairs to provide details and examples. (Possible response: It was Jack Foley’s idea to add sound effects after filming. Foley was a sound technician who created sound effects for Universal Studios for more than 30 years. An example of his sound effects includes his use of a cane to help mimic the sound of two people walking.)

**Make Inferences** Remind students that authors don’t always directly state everything in the text. Readers can use their background knowledge and look for clues in the pictures and text to help them infer meanings the author doesn’t directly state. Model by saying: *The artists in the picture on pages 16 and 17 look very alert, like they are concentrating very hard on something. I can infer that Foley artists need to be very observant to match the timing of the sounds exactly to the movements of the actors and objects in the film. They really have to pay attention to what they are doing.* Have students turn and talk to discuss other details they can infer from the text or pictures. (Possible response: Foley artists must be very inventive and creative to find ways to make sounds with different objects than they see in the film. They may notice sounds and think, “How could I make that sound?” They also need to understand how different objects make sound so they can create sounds that are clear enough to record and are realistic for what viewers see in the film.)

**WRITE & ASSESS**

You may want to have students do a “quick write” to assess understanding. It’s always helpful to have students reflect on both the content and their thinking process.

- **How do Foley artists use sound energy to create sound effects for movies?**
- **What surprised you about what you just read?**
Reading Objectives
- Determine main ideas in a science article.
- Summarize the text.

Science Objectives
- Explain how animators create the optical illusion of nonstop motion.

Common Core State Standards for English Language Arts
CC.4.Rl.2. Determine the main idea of a text and explain how it is supported by key details; summarize the text.

A Framework for K–12 Science Education
Core Idea PS3: Energy
PS3.A: Definitions of Energy
What is energy?
PS3.B: Conservation of Energy and Energy Transfer
What is meant by conservation of energy? How is energy transferred between objects or systems?
Core Idea ETS1: Engineering Design
How do engineers solve problems?

Summary
“Creating Visual Effects” is a science article about how moviemakers use stop-motion animation.

Build Background for the Genre
Ask students to describe what they expect to read in a science article. Have them turn and talk to share their ideas. Tell them that “Creating Visual Effects” is a science article with the following elements:
- It uses facts, details, and examples to present information about a science topic.
- The text is organized using headings and has specialized vocabulary.
- Facts and information are presented through photos and captions.

Build Vocabulary & Concepts
- optical illusion
- static

Remind students that Using Context Clues is a strategy to infer the meaning of an unfamiliar word. They can “read around” the word, or read a few sentences before and after it, to make meaning from the context. Remind them to look at the photographs, too.

Another strategy to try is Becoming Wordkeepers. Explain that a “wordkeeper” is in charge of knowing a word’s meaning, spelling, and part of speech. But remind students that the meaning of the word is the most important thing to remember. Write the term optical illusion and its part of speech on a sticky note and ask if anyone knows its meaning. Write it on the back of the note and invite a student to be the wordkeeper. If no one knows the term, ask a volunteer to learn it and be the wordkeeper. Tell other students they can ask the wordkeeper if they forget its meaning or spelling. Follow the same strategy with the word static.

Point out other important words and terms in the selection, such as three-dimensional, stop-motion animation, silicon, and latex foam. Designate wordkeepers for these and any words or terms that might be unfamiliar to students.
READ

The content goal for At the Movies is for students to learn how moviemakers use different forms of energy to create visual and sound effects. Share that “Creating Visual Effects” describes how artists create films using a technique called claymation. Point out the Read to find out statement at the top of page 20 in the student book: Read to find out how some kinds of special effects are created.

Help students with the comprehension goal of accessing content by inferring and visualizing. Model by reading aloud the text under the heading “Making the Puppets” on page 21. Then say: This paragraph tells about all the separate parts that were created for each character. I can picture more than a thousand mouth shapes lying on a table! I can infer that it must be very time-consuming to create all these different parts, and it must be difficult to keep track of all the parts for each character. So I can also infer that animators using clay animation must be very patient, detail-oriented, and organized to create this type of animation.

Before students begin reading, say: As you read, try to make a mental picture of what the author is describing. Look for clues in the article that help you infer meanings that are not stated in the text.

TURN & TALK

Revisit the Read to find out statement. Have students turn and talk about how some kinds of special effects are created. (Possible response: Animators pose clay models and photograph them. They adjust the poses slightly and continue to photograph the models frame by frame after each adjustment.) To check understanding, have students turn and talk about the Check in question: How does stop-motion animation work? (Possible response: When the film plays, the photographs on the individual frames of film blend together and create an optical illusion. This makes the models look like they are moving.)

Determine Main Ideas Remind students that they can understand and remember text better if they find and understand the main ideas. Say: One way to identify the main ideas is to use text features such as headings. A heading tells the topic of the text that follows. Then readers must determine the most important information about the topic. Model by referring to the text under the heading “Making the Puppets” on page 21. Say: I can tell from this heading that this section is about making the puppets and all that goes with it. So the main idea will have something to do with making the puppets. I think the main idea is that making the puppets required more work than you might expect. Have students work with a partner and use headings to determine other main ideas in the selection.

Summarize Explain that main ideas, along with important details, can be used to summarize a text. Remind students that authors sometimes use text features such as photos and captions, in addition to the text, to present details. Model by focusing on the photo and caption on the top right-hand side of page 23. Say: This picture shows some of the parts used for a clay puppet. The caption describes what the pieces are and how they are used. This helps me understand how the puppets are created. I can summarize that the puppets are made using many different parts for each character that can be mixed and matched to create different poses and facial expressions. Have student pairs page through the article and identify details in the text, photos, and captions that support each of the main ideas they already have identified. Students should then work together to summarize the article.

WRITE & ASSESS

You may want to have students do a “quick write” to assess understanding. It’s always helpful to have students reflect on both the content and their thinking process.

• How are stop-motion animation films created?
• What did this text remind you of?
IMAX® TO THE MAX
Science Article

READING OBJECTIVES
• Explain concepts in a science article.
• Interpret visual information.

SCIENCE OBJECTIVES
• Understand how technology is used to create high-impact visuals and sound in an IMAX theater experience.

COMMON CORE STATE STANDARDS FOR ENGLISH LANGUAGE ARTS
CC.4.RInfo.3 Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.
CC.4.RInfo.7 Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, timelines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.

A FRAMEWORK FOR K–12 SCIENCE EDUCATION
Core Idea PS3: Energy
PS3.A: Definitions of Energy
What is energy?
PS3.B: Conservation of Energy and Energy Transfer
What is meant by conservation of energy? How is energy transferred between objects or systems?
Core Idea ETS1: Engineering Design
How do engineers solve problems?

Summary
"IMAX® to the MAX" is a science article that explains how different forms of energy are used to create 3-D IMAX films.

BUILD BACKGROUND FOR THE GENRE
Ask students what they expect to see and read in a science article. Then tell them that "IMAX® to the MAX" is a science article with the following elements:
• It uses facts, details, examples, and evidence to present information about a science topic.
• Facts and information are presented through photos, captions, and a diagram.
• The text is organized using headings and has specialized vocabulary.

BUILD VOCABULARY & CONCEPTS
• resolution

Remind students that Using Context Clues is a strategy to infer the meaning of an unfamiliar word. They can "read around" the word, or read a few sentences before and after it, to make meaning from the context. Remind them to look at the photographs, too.

Another strategy to try is Creating an Online Image Bank. Select several images from an Internet image site that illustrate the concept of resolution and project them as you present the word resolution, giving students a chance to anchor the meaning of the word with the images.

Point out other important words or terms in the selection, such as computer-generated imagery and three-dimensional. Have students use online image banks or context clues to determine the meaning of these and any words or terms that might be challenging or unfamiliar.
READ

The content goal for At the Movies is for students to learn how moviemakers use different forms of energy to create visual and sound effects. Explain that “IMAX® to the MAX” tells how sound and light energy are used to create 3-D IMAX movies. Point out the Read to find out statement on page 26 in the student book: Read to find out how one movie made its way to giant IMAX screens.

Help students with the comprehension goal of accessing content by inferring and visualizing. Model by reading the second paragraph on page 26 aloud. Then say: This paragraph tells about how much time and money and how many people were needed to make the movie Avatar. I can imagine people working hard to develop all this new technology that was needed. I can infer that the process of creating all the special effects for this movie was very complicated and time-consuming. I can also infer that a lot more effort goes into making a movie than I thought and that there’s a lot of science behind moviemaking.

Before students begin reading, say: As you read, look for clues in the article that help you infer meanings that are not directly stated in the text. Try to make a mental picture of what the author is describing. That can help you understand and infer even more.

TURN & TALK

Revisit the Read to find out statement. Have students turn and talk about how one movie made its way to giant IMAX screens. (Possible response: The makers used new technology, powerful sound, and a special curved screen to make people feel as if they were in the middle of the action. They used 3-D cameras to film two images of each shot. Viewers wore 3-D glasses that sent the correct view to the correct eye so the images appeared to have depth and “leap” off the screen.) To check understanding, have students turn and talk about the Check In question: What are some features of IMAX technology that make it a good format for the movie Avatar? (Possible response: The large curved screen and powerful sound make viewers feel like they are on Pandora. The high resolution lets viewers see detail in the CGI scenes and characters.)

EXPLAIN CONCEPTS

Model how to explain a concept based on information in the text by focusing on what CGI is. Say: The text says that CGI stands for computer-generated imagery. This means that the pictures, or images, we see on the screen were made, or generated, by using computers. The text also explains that actors were used, too, but most of the action was computer generated. Have students turn and talk with a partner to explain how live actors and CGI both were used in the film. Remind them to use the photos and captions as well as the text to develop their explanation. (Possible responses: The live actors were filmed using motion capture suits with cameras in front of their faces so computers could create exact CGI copies of the actors, including their facial expressions and movements. Artists could add ears, tails, and skin color to the CGI characters to make them look like the Na’vi people.)

INTERPRET INFORMATION

Remind students that science articles may present information in both diagrams and text and that it is important to be able to interpret this information in order to understand the article. Have students look at the diagram and read the text on page 30. Ask: How does the information in the text and diagram help you understand how 3-D movies work? Have students turn and talk with a partner about this question. (Possible response: The diagram shows how each eye sees a different image on the screen and how the two images combine so we see depth and distance. The text adds to and clarifies the information in the diagram.)

WRITE & ASSESS

You may want to have students do a “quick write” to assess understanding. It’s always helpful to have students reflect on both the content and their thinking process.

• How are light and sound energy used to create 3-D IMAX movies?
• What questions do you still have after reading?
Discuss

CONTENT & COMPREHENSION GOALS

Foster a discussion about the selections in *At the Movies*. Ask: *In this book, what did you learn about different forms of energy and how they are used to create special effects in movies?* (Possible responses are given in the chart. Students may have more or different information.)

<table>
<thead>
<tr>
<th>Type of Energy</th>
<th>How it is used to create special effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sound</td>
<td>DTS speakers amplify sound.</td>
</tr>
<tr>
<td></td>
<td>Foley artists create sound effects.</td>
</tr>
<tr>
<td></td>
<td>IMAX movies use powerful speakers to immerse the audience in sound.</td>
</tr>
<tr>
<td>Light</td>
<td>Animation is created using optical illusions.</td>
</tr>
<tr>
<td></td>
<td>Polarized lenses filter light in different directions, helping us to see depth in 3-D movies.</td>
</tr>
</tbody>
</table>

The four selections in *At the Movies* are one history article and three science articles. Physical science concepts (light and sound energy and optical illusions) thread through the selections. Guide a discussion about these science concepts.

What makes the selections especially interesting to read, though, is the interdisciplinary context—real-life stories that include not only physical science but technology, engineering, and history. After you have explained what *interdisciplinary* means, have students turn and talk about the interdisciplinary nature of the selections. You might ask: *How is reading At the Movies different from reading a textbook about forms of energy?* Also ask them to consider the differences in the ways the selections were written (such as genre, text structure, and point of view) and how the writing style helps the science concepts come alive.
DISCUSS

Have students collaboratively answer the questions on page 32 as you move about the room and listen in to support and scaffold student conversations and clarify misconceptions.

1. How did the information in “Fantasy Movies” help you understand the other three pieces in the book? (Possible response: It gave me some background information and examples of different special effects and how they were used and developed over time.)

2. What were some causes of the sound effects in “Tricks for Sound”? Make up two more sound effects yourself. (Possible response: Snapping leather belts caused the sound effect of reins snapping. Crumpling cellophane candy wrappers caused the sound effect of crackling fire in a fireplace. Student sound effects will vary.)

3. How were the optical illusions created in “Fantasy Movies” and “Creating Visual Effects” similar, and how were they different? (Possible response: The animations in The Incredible Mr. Limpet and The Pirates! Band of Misfits were all created using optical illusions, but the pirates were created with clay models, while Henry the fish was created by painting images on celluloid. The sets in The Pirates! Band of Misfits and Willy Wonka & the Chocolate Factory were both created with many pieces and lots of detail, but the pirates were created with clay, silicon, latex foam, and metal, while the chocolate room was created with real, edible materials. The Pirates! Band of Misfits and Hugo both used green screens to add CGI backgrounds after filming and also used stop-action animation.)

4. Think about your favorite movie. What did you learn in this book that might help explain how your favorite movie was made? (Responses will vary but should include examples of special effects or techniques similar to those described in At the Movies.)

5. What do you still wonder about how movies are filmed? What would be some good ways to find more information? (Responses will vary, but students should mention ideas and concepts related to energy and special effects in movies and should describe a variety of references, such as books and magazine articles, reliable Internet sites, and talking with experts.)
In small groups or individually, offer students the chance to explore questions they have or ideas they still wonder about, based on their reading in *At the Movies*. Use question 5 on the Discuss page of the student book as a springboard for student questions and ideas for further research.

**EXPLORE**

Encourage students to express their curiosity in their own way. The questions students have matter. You might have students talk with peers, write about what they wonder, or create drawings based on what they learned from reading the different selections in *At the Movies*. Guide them to immerse themselves in resources related to what they are most interested in learning more about. They might ask questions or make statements about their interests, for example:

- Who are some pioneers who developed special effects for movies?
- What are some special effects in one of my favorite movies? How were the special effects created?
- How are light and sound energy used to create special effects in live theater productions?

**GATHER INFORMATION**

After students explore, they should arrive at a question that will drive their research. Students may want to read, listen to, and view information with their question in mind. Guide students to use resources, such as reliable sites on the Internet, science texts and articles, library books, and magazines, that address the question they posed. Collecting information may lead students to revise or narrow their question.

You may want students to follow a specific note taking system to keep track of their thinking and findings as they gather information. In addition to taking notes, ask students to make a list of their sources. You may want to model how to take notes by interacting with text, jotting down your thoughts in the margins or on sticky notes, and demonstrating how to summarize the most important information. Remind students that their question will drive their research and note taking.
ANALYZE & SYNTHESIZE

Guide students to carefully and thoughtfully review their notes to determine the big ideas related to their question. As students prepare to use the information they've gathered to formulate an answer to their question, support them as they analyze and synthesize. Be sure they do the following:

• Revise any misconceptions.
• Notice any incongruities in their information.
• Evaluate all the various pieces of information.
• Pull together the most pertinent information that addresses their question.

While analyzing and synthesizing their research, students may realize that the more they learn, the more they wonder. To help focus their thinking, students may want to talk with classmates or write in a research notebook. Remind them that just as in real-world scientific research, there may not be a final answer to the question they posed.

SHARE

When students share their research, they become teachers, consider how their ideas were shaped by the investigation, and pose new questions. Students may express their knowledge by writing, speaking, creating a visual piece, or taking action in the community. The best culminating projects are those with authentic purposes. For example, the student who is interested in learning about how light and sound energy are used to create special effects in live theater productions may want to visit and talk to the lighting and sound technicians at a local or high school theater. The student may want to give a classroom presentation showing how lighting and sound effects are created in the theater. He or she can show diagrams or models of how the lighting and sound effects work.

When students are given time to gather information about a topic that interests them, they find unique and individual ways to share what they learned. Some options you can suggest might include the following:

• eBooks with photos and text to share with other students who are building background on the topic of light and sound energy
• A model that shows how light or sound energy works to create a special effect
• A simple flip book or an animation using techniques such as stop-motion
• A short film using light and sound effects the student has created
Correlation

Grade 4 Common Core State Standards for English Language Arts and
A Framework for K–12 Science Education
correlated to National Geographic Ladders Science

<table>
<thead>
<tr>
<th>Common Core State Standards for English Language Arts, Grade 4</th>
<th>At the Movies Teacher’s Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reading Standards for Informational Text</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Key Ideas and Details</strong></td>
<td></td>
</tr>
<tr>
<td>1. Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.</td>
<td>Pages 9–10, 15–16</td>
</tr>
<tr>
<td>2. Determine the main idea of a text and explain how it is supported by key details; summarize the text.</td>
<td>Pages 11–12</td>
</tr>
<tr>
<td>3. Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.</td>
<td>Pages 13–14</td>
</tr>
<tr>
<td><strong>Craft and Structure</strong></td>
<td></td>
</tr>
<tr>
<td>4. Determine the meaning of general academic and domain-specific words or phrases in a text relevant to a grade 4 topic or subject area.</td>
<td></td>
</tr>
<tr>
<td>5. Describe the overall structure (e.g., chronology, comparison, cause/effect, problem/solution) of events, ideas, concepts, or information in a text or part of a text.</td>
<td>Pages 7–8</td>
</tr>
<tr>
<td>6. Compare and contrast a firsthand and secondhand account of the same event or topic; describe the differences in focus and the information provided.</td>
<td></td>
</tr>
<tr>
<td><strong>Integration of Knowledge and Ideas</strong></td>
<td></td>
</tr>
<tr>
<td>7. Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.</td>
<td>Pages 13–14</td>
</tr>
<tr>
<td>8. Explain how an author uses reasons and evidence to support particular points in a text.</td>
<td></td>
</tr>
<tr>
<td>9. Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.</td>
<td>Pages 15–16</td>
</tr>
<tr>
<td><strong>Range of Reading and Level of Text Complexity</strong></td>
<td></td>
</tr>
<tr>
<td>10. By the end of the year, read and comprehend informational texts, including history/social studies, science, and technical texts, in the grades 4–5 text complexity band proficiently, with scaffolding as needed at the high end of the range.</td>
<td>If the entire NG Ladders Science grade 4 program is used throughout the year, students will have had exposure to multiple genres, multiple levels, and appropriate scaffolding.</td>
</tr>
<tr>
<td><strong>Writing Standards</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Text Types and Purposes</strong></td>
<td></td>
</tr>
<tr>
<td>1. Write opinion pieces on topics or texts, supporting a point of view with reasons and information.</td>
<td></td>
</tr>
<tr>
<td>2. Write informative/explanatory texts to examine a topic and convey ideas and information clearly.</td>
<td></td>
</tr>
<tr>
<td>3. Write narratives to develop real or imagined experiences or events using effective technique, descriptive details, and clear event sequences.</td>
<td></td>
</tr>
</tbody>
</table>

(cont. on p. 20)
### Production and Distribution of Writing

4. Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.

5. With guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, and editing.

6. With some guidance and support from adults, use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others; demonstrate sufficient command of keyboarding skills to type a minimum of one page in a single sitting.

### Research to Build and Present Knowledge

7. Conduct short research projects that build knowledge through investigation of different aspects of a topic.

8. Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.

9. Draw evidence from literary or informational texts to support analysis, reflection, and research.

### Range of Writing

10. Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

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### A Framework for K–12 Science Education

<table>
<thead>
<tr>
<th>Core Idea</th>
<th>Description</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS3.A: Definitions of Energy</td>
<td>What is energy?</td>
<td>4–16</td>
</tr>
<tr>
<td>PS3.B: Conservation of Energy and Energy Transfer</td>
<td>What is meant by conservation of energy? How is energy transferred between objects or systems?</td>
<td>4–16</td>
</tr>
<tr>
<td>ETS1: Engineering Design</td>
<td>How do engineers solve problems?</td>
<td>4–14</td>
</tr>
</tbody>
</table>

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acoustics  (noun) a field of study having to do with sound energy and how it moves
amplify  (verb) to increase the strength of a signal
optical illusion  (noun) something that appears different from what actually exists
resolution  (noun) the amount of detail visible in an image
static  (adjective) lacking in movement or change

Glossary

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Ladders Science

Physical Science  Let’s Cook • At the Movies
Super Structures • Let’s Keep Moving!

Earth Science  The Good Earth • Patterns
Explorer Tim Samaras: Tornadoes
The Chesapeake Bay

Life Science  Weird but True! • Smart Animals
Exploring Coral Reefs • Taming the Wild