TEACHER'S GUIDE

Adventurer
January-February 2016

In This Guide

In this guide, you will find language arts and science lessons for the stories in the January-February issue of Explorer Adventurer.

Explorer Magazine

Explorer magazine is a classroom magazine specifically written for each grade, 2-5. Each grade's magazine contains a grade-appropriate reading experience, develops literacy skills and teaches standards-based science content. Great storytelling and stunning photographs teach your students about our planet and the people, plants, and animals that live on it. Use Explorer in your classroom to encourage students to explore our world and make it a better place.

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Kelp Kingdom

LANGUAGE ARTS

Objectives

- Students will predict definitions and then write sentences to better understand unfamiliar words.
- Students will use a variety of techniques to strengthen their understanding of content-related academic terms.
- Students will recognize a second-person narrative.

Resources

- Vocabulary Assessment Master (page 6)
- Language Arts Assessment Master (page 7)

Summary

- The article "Kelp Kingdom" takes readers on a journey through the Monterrey Bay kelp forest to examine one of the most productive and dynamic ecosystems on Earth.

BUILD VOCABULARY AND CONCEPTS

- **consumer**
- **decomposer**
- **ecosystem**
- **keystone species**
- **photosynthesis**
- **producer**

Give each student a copy of the **Vocabulary Assessment Master**. Point out to students that they have likely heard some or all of these words before.

Using that background knowledge as a base, instruct students to predict and write a definition for each word. Then have them write a sentence using each word, based on the definitions they wrote.

Display the Wordwise feature on page 9 of the projectable magazine. Review the definitions as a class. Have students add these definitions to their worksheets. Instruct them to write new sentences, using each word as it is defined in the article.

Invite volunteers to read aloud the before and after sentences they wrote for each word. As a class, examine how new knowledge contributed to students' understanding of each word.

READ

Inform students that the purpose of this article is to introduce them to one of the most productive and dynamic ecosystems on Earth—a kelp forest off the coast of California.

Point out to students that in order to understand what kelp is and why this underwater forest is so extraordinary, readers must understand the scientific terms used to describe this place and the organisms that call it home.

Give each student a copy of the **Language Arts Assessment Master**. Tell students that they will use this worksheet to explore words in four different ways: define the word, identify examples, connect one word to another, and examine the results.

Display the Wordwise feature on page 9 of the projectable magazine. Highlight the word *consumer*. Instruct students to record its definition. Challenge students to locate the word *consumer* in the article. (page 4, column 2) Then model how to explore the word's meaning. **Say:** *According to the definition in the article, a consumer is a living thing that eats other living things for food. The sentence where the bold word appears says that fish and sea otters are consumers. These two bits of information are like pieces of a puzzle. To put the puzzle together, I have to see how these and other pieces of information are connected.*

Point out that four of the other definitions also contain the term *living things*. **Say:** *Using living things as a basis, I can connect the word* consumers *to several other words. Based on the information I have here, I can conclude that consumers, decomposers, and producers are types of living things that interact in an ecosystem. Consumers eat other living things, so I can conclude that they don't conduct photosynthesis and make their own food. I can also conclude that most consumers are animals. Very few plants eat other living things.*

Have students read the article in on their own.

Kelp Kingdom

LANGUAGE ARTS

TURN AND TALK

Have students turn and talk to discuss what they learned about the six vocabulary words. Encourage them to compare their results in small groups. Instruct students to discuss how examining the information they collected impacted their understanding of each term.

• **Strengthen Understanding** Remind students that while they had may have been familiar with many of the vocabulary words identified in this article, they may not have been as familiar with the words' scientific definitions. **Say:** *Words can have different meanings depending on the context in which they are used. Good readers examine the context to determine which definition is required. That allows them to use the word correctly when discussing the topic.* Challenge students to make accurate statements using each of the vocabulary words. Encourage them to use their **Vocabulary Assessment Masters** and their **Language Arts Assessment Masters** as resources. But remind them to be original. Students shouldn't restate sentences from the article. They should create new sentences of their own.

• **Recognizing Second-Person** After reading the article, ask a volunteer to identify the first word in the article. (you) Point out how many times this pronoun was used in the article. Challenge students to explain why. Guide them to recognize that this article is written in the second person. Discuss what that means. **Say:** *Most often, articles are written from the first-person or third-person point of view. First person tells what* I *did. Third person refers to* he, she, *or* they. *Once in a while, writers decide to pull readers right into the action. A marine scientist isn't swimming through the kelp, you are! You are the main character as the story unfolds.* Encourage students to explain how using the second-person point of view affected their enjoyment or interpretation of the article.

WRITE AND ASSESS

You may want students to write about what they learned to assess understanding. Encourage students to reflect upon what they read and how it affected their ideas about the topic.

- *What lives in a kelp forest?*
- *Why is it important for scientists to study underwater ecosystems?*
- *What surprised you about what you read?*

Kelp Kingdom

SCIENCE

Objectives

- Students will understand what kelp is.
- Students will categorize organisms in a kelp forest.
- Students will recognize how energy moves from the sun to kelp and then to other organisms in an underwater ecosystem.

Resources

- Content Assessment Master (page 8)
- Comprehension Check (page 9)

Science Background

The Monterey Bay Marine Sanctuary is a protected area covering roughly 15,800 square kilometers off the coast of California. It includes one of the deepest and largest canyons in North America and provides a home for a multitude of plant and animal species.

One important member of this cold, coastal environment is kelp, a type of seaweed. Two types of kelp grow in the sanctuary, giant kelp and bull kelp. Together, they cover about 65 square kilometers, creating a giant kelp forest.

Kelp grows fast. Giant kelp can grow up to 18 inches a day. Each specimen has three main parts: the holdfast, which anchors kelp to the ocean floor; a stipe, which looks like the stem of a plant; and blades, which are similar to leaves and flutter in the ocean currents. Gas-filled sacs allow the blades to float in the water.

Kelp forests are diverse ecosystems. The sheer mass they contain minimizes wave action, creating a safe place for plants and animals to live. In essence, kelp forests protect plants and animals in the ocean just as forests filled with trees do on land.

Also like land forests, kelp forests have layers. The top layer, or canopy, is where most animals live. Snails and other organisms live in the understory in the middle. Sea urchins and brittle stars are two of the more common organisms found near the holdfast on the kelp forest floor.

ENGAGE

Tap Prior Knowledge

Instruct students to close their eyes and imagine that they're walking through a forest thick with trees. They see birds on the branches and small animals on the ground. The wind is blowing gently through the leaves. Suddenly they enter a large clearing where the wind is blowing hard. Challenge students to explain why. (The trees are no longer blocking the wind.) Instruct students to examine the photos in the article. Encourage them to compare this underwater forest to a forest full of trees.

EXPLORE

Preview the Lesson

Invite a volunteer to read aloud the headline and subhead on pages 2-3. Give students a moment to examine the photo. **Ask:** *What is the seal doing?* (swimming) Point out that the seal needs energy to do this. Invite students to identify where this energy originated. (the sun) Encourage them to share what they know about how it made its way to the seal.

Set a Purpose and Read

Have students read the article in order to recognize how energy moves through a kelp forest ecosystem.

EXPLAIN

Understanding Kelp

Display the diagram of kelp on page 5 of the projectable magazine. Examine the parts of kelp. Challenge a volunteer to identify these parts on the kelp in the photos. **Ask:** *How do these parts help kelp survive?* (The gas sacs cause the blades to float in the water. The blades rise to the surface where they access the sunlight kelp uses to make its own food during photosynthesis.) **Ask:** *How do these parts help other organisms survive?* (The blades fan out to create a protective canopy where other organisms can live and survive.) Challenge students to identify and describe other kelp parts mentioned in the article. (Gas sacs connect to the stem, which extends the length of kelp. The holdfast is a tangle of wood structures that anchor kelp to the seafloor.)

EXPLAIN

(continued)

Categorize Organisms in a Kelp Forest
Inform students that in order for any ecosystem to survive, the organisms that live there must be able to find food. An underwater ecosystem is no different. Energy moves from the sun to producers and then on to one or more consumers. Decomposers break everything down so the cycle can continue. Give each student a copy of the **Content Assessment Master**. Instruct the class to examine the images in the article and categorize each organism they see. Encourage them to review the article to add more organisms to their lists. Challenge students to summarize what the lists reveal about organisms that live in a kelp forest ecosystem.

Tracking Energy in a Kelp Forest
Explain to students that while every organism in an ecosystem is important, some are essential for the ecosystem to survive. These organisms are called keystone species. **Ask:** *What is the keystone species in this ecosystem?* (otter) As a class, trace the flow of energy as it moves from the sun to kelp, sea urchins, and otters. **Ask:** *What would happen to this ecosystem if the otters disappeared?* (The ecosystem will fall apart.) *Why?* (Otters eat sea urchins. Without the otters, sea urchins would eat the anchors off of all of the kelp. The kelp forest would disappear. Animals that eat kelp would have no food. Those that depend on kelp for protection would struggle to survive in the open ocean environment.)

ELABORATE

Find Out More
Remind students that the article introduced them to two different types of kelp: giant kelp and bull kelp. As a class, compare and contrast these two different species of seaweed. Instruct students conduct research to learn more about how and where the two types of kelp grow.

Extend Your Thinking About Kelp
Remind students that the kelp forest they read about in the article is located in the Monterey Bay National Marine Sanctuary. Encourage students to conduct research to learn what a marine sanctuary is and why monitoring the health of these locations is important.

EVALUATE

Have students record their answers to the assessment questions in their science notebooks or on a separate sheet of paper.

- *Why is kelp classified as a producer?* (It makes its own food.)
- *Why are kelp forests important?* (They provide food and shelter for thousands of marine species.)
- *Why are sea urchins a threat to kelp forests?* (Sea urchins gather on the holdfast of kelp and chew. They can uproot the kelp and destroy a kelp forest.)

If you wish, have students complete the **Comprehension Check** to assess their knowledge of concepts mentioned in the article.

Name _____ Date _____

VOCABULARY ASSESSMENT: Kelp Kingdom

Use this organizer to study each vocabulary word in the article.

Word						
Predicted Definition						
Sentence						
Definition from the Article						
Sentence						

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Name ______________________________ Date ____________________

LANGUAGE ARTS ASSESSMENT: Kelp Kingdom

Use this graphic organizer to explore each vocabulary word from a scientific point of view.

Define	Identify
Word	
Examine	Connect

Define	Identify
Word	
Examine	Connect

Define	Identify
Word	
Examine	Connect

Define	Identify
Word	
Examine	Connect

Define	Identify
Word	
Examine	Connect

Define	Identify
Word	
Examine	Connect

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Name _____ Date _____

CONTENT ASSESSMENT: Kelp Kingdom

Identify producers, consumers, and decomposers that live in a kelp forest ecosystem. Summarize what the lists tell you about organisms that live here.

Producers
Consumers
Decomposers
Summary

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Name _____ Date _____

COMPREHENSION CHECK: Kelp Kingdom

Read each question. Fill in the circle next to the correct answer or write your response on the lines.

1. What is kelp?

   Ⓐ a type of tree

   Ⓑ a type of seaweed

   Ⓒ a type of grass

2. How does kelp get food?

   Ⓐ It eats producers.

   Ⓑ It eats consumers.

   Ⓒ It makes its own food.

3. Which part attaches kelp to the ocean floor?

   Ⓐ blade

   Ⓑ gas sac

   Ⓒ holdfast

4. What organism can destroy a kelp forest?

   Ⓐ sea anemone

   Ⓑ sea urchin

   Ⓒ harbor seal

5. Give one example of how energy cycles through organisms in a kelp forest ecosystem?

_____

_____

_____

_____

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Robot Revolution

LANGUAGE ARTS

Objectives

- Students will recognize how vocabulary words are connected.
- Students will analyze and compare multiple accounts of the same topic.
- Students will explain concepts based on information in the text.

Resources

- Vocabulary Assessment Master (page 14)
- Language Arts Assessment Master (page 15)

Summary

- The article "Robot Revolution" profiles a collection of robots created to address different humans problems or meet specific needs.

BUILD VOCABULARY AND CONCEPTS

- **caregiver robot**
- **humanoid robot**
- **robot**
- **swarm robots**
- **technology**

Instruct students to turn to page 15 of their magazines. Tell them to read the vocabulary words in the Wordwise feature to themselves.

Then give each student a copy of the **Vocabulary Assessment Master**. Tell students to look at the diagram and think about the words. Encourage them to write the words and their definitions in the way they think matches the structure of the diagram. Challenge them to explain why they arranged the words as they did.

Have students compare their results in small groups. Encourage them to explain why they organized the words as they did. Allow students to revise their work if they decide another arrangement works better after consulting with classmates.

READ

Let students know that the purpose of this article is to learn about different types of robots that people have created.

Point out to students that while the people in the article are all using robots, their experiences are quite different. Because of that, how they feel about using robots will vary, too. Tell students that examining different points of view is one strategy that helps readers understand new topics.

Say: *A robot is a type of machine. People use machines for many different reasons. Machines can make jobs easier to complete, accomplish a task that would be impossible for a human to do, or simply be used for fun.*

Point out that how people feel about using machines can vary, too. **Say:** *Think about a video game you like to play. If you had to pick a couple of words that describe how you feel when you play that game, they might be* happy, excited, *or* engaged. *If you handed your game over to someone who had never played it before, that person might describe the experience as* frustrating, challenging, *or* discouraging. *The two of you played the same game, but you had different experiences. If someone asked both of you what the game was like, they'd get two very different opinions*

Give each student a copy of the **Language Arts Assessment Master**. Instruct students to read the article on their own. As they do, encourage them to identify the type of person who uses each robot and write a quote telling how they think that person feels about using the machine.

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Robot Revolution

LANGUAGE ARTS

TURN AND TALK

Have students turn and talk to discuss what they learned about robots. **Ask:** *Why is each of these machines considered to be a robot?* (Each one performs a human task or imitates human actions.) *What do they all have in common?* (They help humans.) Encourage students to share what they learned about the different types of robots.

• **Analyze Multiple Accounts** Have students share their **Language Arts Assessment Masters** in small groups. Tell students to analyze the quotes they wrote relating to each robot. Did they interpret each person's experience in the same way? If not, instruct students to reread disputed sections until they come to a consensus on how that person felt about using a robot. Then have students compare the quotes the wrote relating to different robots. **Ask:** *Why do you think the people felt differently about using these robots? How does a robot's purpose affect how people feel about using the machine?*

• **Explain Concepts** After reading the article, **say:** *One way to see if you understand information is to try to tell someone else about the topic. If you can't explain the concept, you might need to read the article again.* Have students turn and talk to explain to a partner why some of the robots in the article are humanoid robots and some are not. Prompt discussion with questions.

WRITE AND ASSESS

You may want students to write about what they learned to assess understanding. Encourage students to reflect upon what they read and how it affected their ideas about the topic.

- *Do you think people need robots? Why?*
- *Which robot do you think is the most useful? Why?*
- *What surprised you about what you read?*

Robot Revolution

SCIENCE

Objectives

- Students will understand what a robot is.
- Students will recognize that robots are designed to solve problems.
- Students will compare and contrast robots that people use.

Resources

- Content Assessment Master (page 16)
- "Robot Revolution" poster (Teacher's Edition)
- Comprehension Check (page 17)

Science Background

Robots are machines that perform human tasks or imitate human actions. While they may seem like a modern-day invention, the idea for robots has deep roots in history.

Muslim scientists developed simple robotic contraptions more than 1,000 years ago. Ancient Greeks and Romans built machines that moved by themselves. In the late 1400s, Leonardo da Vinci sketched plans for a humanoid robot, though the ability to build a robot like this was far into the future.

Advances in technology are allowing people to create robots as never before. The big, bulky, metal taskmasters of the past now have smaller counterparts that can comfort, carry, and disarm bombs. Some robots help surgeons perform procedures. And engineers are developing robots that work together as they canvas an area to search for survivors, inspect crops, or clean up environmental hazards.

Da Vinci's dream of a humanoid robot has also come true. These robots, which resemble humans, can perform many of the same task as people without the help of a brain. Other robots are designed to resemble animals. In Japan, many people keep these robots as pets.

ENGAGE

Tap Prior Knowledge

Give each student a piece of plain white paper and a pencil. Instruct students to draw a picture of a robot. Invite volunteers to share their sketches with the class. Compare the drawings to identify similarities and differences. Invite students to tell what each of their robots does.

EXPLORE

Preview the Lesson

Instruct students to read the headline and text and examine the photo on pages 10-11 of their magazines. Encourage them to describe the robot they see. **Ask:** *What problem does this robot solve?* (Possible response: It provides a friend for people who need one.) *How does the robot do this?* (It responds to people's moods.) *How might its design help people see it as a friend?* (It looks a little bit like a person.) Ask students if they would like to have a robot like this. Invite students to share their opinions.

Set a Purpose and Read

Have students read the article to learn about different types of robots and the problems they were designed to solve.

EXPLAIN

Understanding What a Robot Is

Display page 15 of the projectable magazine. Zoom in on the Wordwise feature and read aloud the definition for *robot*. Inform students that all robots are machines, but not all machines are robots. To be classified as a robot, a machine must perform a human task or imitate a human action. **Say:** *An oven is a machine, but an oven doesn't do something that a human can. Someone needs to operate the oven. Pepper is a robot. Pepper can sense how people feel. If you're feeling sad, Pepper will respond like a friend would*. Examine the other machines in the article. Challenge students to explain why each one is a robot.

Robot Revolution

SCIENCE

EXPLAIN

(continued)

Recognize How Robots Solve Problems
Inform students that people build many different types of robots. All robots are designed to solve specific problems, but what a robot looks like and how it functions depends upon its purpose. Display the **"Robot Revolution" poster**. Review the information with the class. Then give each student a copy of the **Content Assessment Master**. Encourage students to record information about each robot. Challenge them to analyze that information to identify the purpose of each robot identified in the article.

Compare and Contrast Robots
Give each student a piece of plain white paper. Instruct students to draw a Venn diagram. Instruct students to each select two robots in the article. Tell them to compare and contrast the two robots in as many was as they can. Encourage students to review the article for details about the robots they selected. Recommend that they use their **Content Assessment Masters** as well. Invite students to present their findings to the class.

ELABORATE

Find Out More
Remind students that swarm robots are one of the newest innovations in robot technology. Assign each student a partner. Tell pairs to conduct research to learn more about swarm robots. Challenge them to identify at least five problems swarm robots could help solve.

Extend Your Thinking About Humanoid Robots
Remind students that a humanoid robot is a robot that looks like a human in some way. Have students review the article's photos in their magazines. As a class, identify which robots have human traits. Challenge students to explain how the human traits help the robots solve the problems they were designed to solve.

EVALUATE

Have students record their answers to the assessment questions in their science notebooks or on a separate sheet of paper.

- *What problem does ROSA solve? How?* (ROSA helps doctors perform brain surgery. The robot creates a detailed map of the patient's brain that shows doctors exactly where to operate. It has a robotic arm that inserts tiny instruments into pinpoint holes in the patient's skull.)

- *How are swarm robots different from other robots?* (They act together to get a job done. They don't solve a problem on their own.)

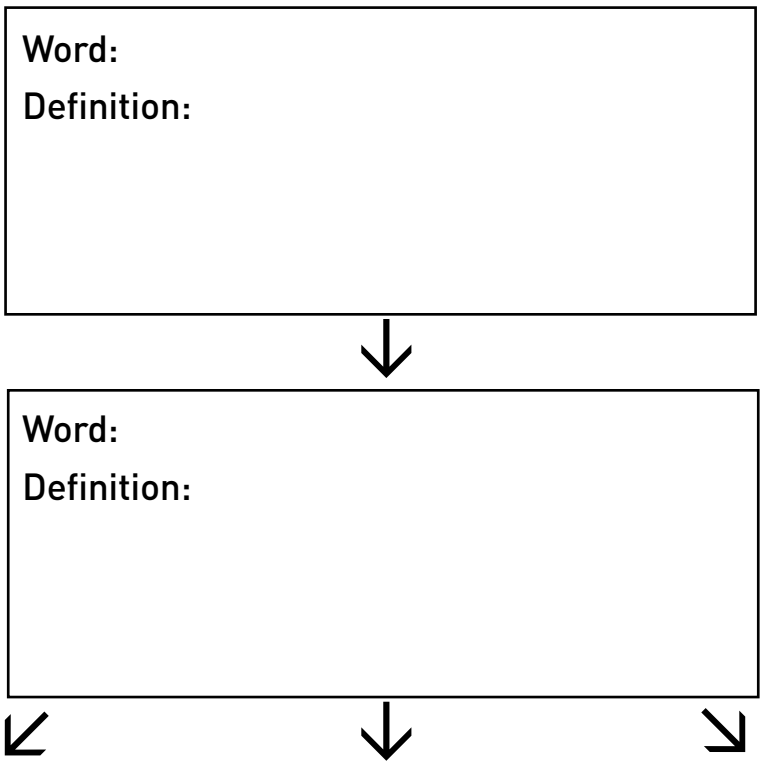
- *Which type of robot is designed to provide care and comfort to patients?* (caregiver)

If you wish, have students complete the **Comprehension Check** to assess their knowledge of concepts mentioned in the article.

Name _____ Date _____

VOCABULARY ASSESSMENT: Robot Revolution

Use this organizer to show how the vocabulary words in the article are connected. Explain why you arranged the words in this way.



Explanation:

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Name _____ Date _____

LANGUAGE ARTS ASSESSMENT: Robot Revolution

Identify the type of person who would use each robot. Write a quote telling how you think that person feels about using the machine.

Pepper Person: Quote:	**Robo Sally** Person: Quote:
ROSA Person: Quote:	**Paro** Person: Quote:
Robobear Person: Quote:	**swarm robots** Person: Quote:

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Name _____ Date _____

CONTENT ASSESSMENT: Robot Revolution

List the robots in the article. Record information about each. Identify the problem each robot solves.

Identify the Robot	What does it look like?	What does it do?	What problem does it solve?

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Name _____ Date _____

COMPREHENSION CHECK: Robot Revolution

Read each question. Fill in the circle next to the correct answer or write your response on the lines.

1. Which of these robots is a humanoid robot?

   Ⓐ Pepper

   Ⓑ ROSA

   Ⓒ Paro

2. What does Robobear do?

   Ⓐ stop bombs

   Ⓑ lift people

   Ⓒ perform surgery

3. What do Robo Sally and ROSA have in common?

   Ⓐ Both are humanoid robots.

   Ⓑ Both have wheels.

   Ⓒ Both save lives.

4. What do all robots do?

   Ⓐ build technology

   Ⓑ look like humans

   Ⓒ solve problems

5. Pick a robot from the article. Describe what it does. Tell how that helps humans.

_____

_____

_____

_____

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Seeing Eye to Eye

LANGUAGE ARTS

Objectives

- Students will create sketches to understand the meaning of unfamiliar words.
- Students will distinguish between facts stated explicitly and inferences made using information in the text.

Resources

- Vocabulary Assessment Master (page 22)
- Language Arts Assessment Master (page 23)

Summary

- The article "Seeing Eye to Eye" examines the anatomy of an eye and explains how eyes work. In addition, the article explores how the changes in the structure of the eye affects how people and animals see.

BUILD VOCABULARY AND CONCEPTS

- **focus**
- **reflect**
- **refract**
- **visible**
- **vision**

Display the vocabulary words on a word wall or on the white board. Point out to students that when they read they will encounter words they don't know. Remind them that using context clues such as the sentences before and after an unknown word and photographs on the page can help them figure out what the unfamiliar word means.

Invite a volunteer to read the definition of *focus* in the Wordwise feature on page 23 of the article. Examine this word in context. Then give each student a copy of the **Vocabulary Assessment Master**. Instruct students to write the word's definition and create a detailed sketch showing what it means. Inform students that their drawings won't all be the same. The point is for students to draw the word in a way that will help them remember its definition. Examine the other words in this way, too.

READ

Inform students that the purpose of this article is to explain how eyes work. As they read, they'll learn about parts of the eye, how those parts turn light into sight, and about variations in eyes that cause humans and animals to see in different ways.

Tell students that one skill that all good readers have is the ability to make inferences as they read. **Say:** *When writers write, sometimes they use facts to say exactly what they mean. These facts are explicit statements. Other times, they leave clues for readers to follow. Those clues help readers make inferences, which are logical conclusions based on information in the text.*

Display pages 16-17 of the projectable magazine. Give students a moment to read the headline and subhead and examine the photos. **Say:** *There's not a lot of text on these two pages, but the little text that there is tells me a lot. After reading it, I know that the article is about eyes and that eyes can see. I know that organisms have different numbers of eyes and that eyes turn light into sight. If I examine the photos, I know that eyes come in different sizes, colors, and positions.*

Inform students that you can use this information to make inferences. **Say:** *To make an inference, I have to combine what I already know with what I learn from the article. For example, in each photo the eyes are on the organism's head. I've never seen an animal with eyes anywhere else, so I can infer that eyes are typically found on an animal's head. I also see many different types of animals. I know that there are mammals, birds, reptiles, amphibians, and insects. I can infer that all types of animals have eyes.*

Give each student a copy of the **Language Arts Assessment Master**. Have students read the article on their own. As they do, instruct them to record five explicit statements and make five inferences about eyes.

Seeing Eye to Eye

LANGUAGE ARTS

TURN AND TALK

Have students turn and talk to discuss what they learned about eyes. **Ask:** *What's the difference between being visible and having vision?* (If something is visible it is able to be seen. If someone has vision, they have the sense of sight.) *How is the human eye like a camera?* (Both have a lens that brings an image into focus. Both have lens openings that can adjust to different levels of light. The eye sends a constant stream of images to the brain by electrical signals, just as a camera stores images.) *What does an eye need to see?* (light)

• **Interpret Visual Information** Explain to students that reading definitions tells people what words mean. But sometimes readers have to "see" words to really understand them. Point out that this is exactly what they did when they drew sketches of the vocabulary words in the article. They drew the words in a way that had meaning to them. Instruct students to turn and share the sketches they created on their **Vocabulary Assessment Masters** with a partner. Encourage them to explain how their drawings reflect the meaning of each word.

• **Explicit Statements and Inferences** Remind students that an explicit statement is something directly stated in the text. An inference is a logical conclusion reached after combining what you already know with information in the text. Have students share their Language Arts Assessments Masters with a partner. Encourage them to point out where in the article they found each explicit statement. Instruct them to evaluate the validity of each inference. If any inferences are questionable, encourage partners to reread the article to search for more clues.

WRITE AND ASSESS

You may want students to write about what they learned to assess understanding. Encourage students to reflect upon what they read and how it affected their ideas about the topic.

- *What causes a shirt to look yellow?*
- *Why do some nocturnal animals have very large eyes?*
- *What surprised you about what you read?*

Seeing Eye to Eye

SCIENCE

Objectives

- Students will understand the sense of sight.
- Students will identify the rules of light.
- Students will recognize how variations in traits affect how animals see.

Resources

- Content Assessment Master (page 24)
- "Light Catchers" poster (Teacher's Edition)
- "Seeing Eye to Eye" Interactive Whiteboard (optional)
- Comprehension Check (page 25)

Science Background

At just 2.5 centimeters long and about seven grams, the human eye isn't large. Yet it's extremely powerful. An eye can capture light and transform it into an image for the brain to interpret. Eyes are our windows to the world.

An eye has several important parts. The cornea is a see-through dome that helps focus light. It lies in front of the iris, which is the colored part of the eye. Muscles attached to the iris help it change shape and control how much light enters the pupil, the black circle in its middle.

About two-thirds of an eye is filled with a gel-like material that gives the eye its shape.

The lens lies behind the iris. It focuses light onto the retina at the back of the eyeball. The retina contains millions of light-sensitive cells. It captures light and sends messages to the brain.

Eyes can do amazing things, but not all eyes are the same. Often, the differences have a purpose. For example, cats have an extra part in their eyes that lets them catch light twice. They can see up to eight times better in the dark than humans can. Birds of prey use their binocular vision to spot prey up to three kilometers away. And while humans can only see light in the visible spectrum, rattlesnakes can detect electromagnetic radiation in the infrared range. This helps them find prey.

ENGAGE

Tap Prior Knowledge

Instruct students to take out a sheet of paper. Give them 30 seconds to make a list identifying everything they can see. Then turn off the lights. If this doesn't make the room dark, ask students to close their eyes instead. Instruct students to make a list of things they can see now. Compare the lists. Discuss why it was impossible to see as many things in the dark. Invite students to share what they know about eyes.

EXPLORE

Preview the Lesson

Display pages 16-17 of the projectable edition. Read aloud the subhead. Point out that it states that eyes turn light into sight. **Ask:** *How do you know that this statement is true?* (You can only see when it's light out. If it's very dark, you can't see anything—even if your eyes are open.) Tell students that they'll learn how the sense of sight works as they read the article.

Set a Purpose and Read

Have students read the article in order to understand the sense of sight, identify the rules of light, and recognize how variations in traits affect how animals see.

EXPLAIN

Understand the Sense of Sight

Display the diagram of the eye on page 19 of the projectable magazine. As a class, identify each part of the eye. Review the article for information on what each part does. **Ask:** *How do the parts of the eye work together to give us the sense of sight?* (The cornea, iris, pupil, and lens work together to catch and focus light. They send light to the retina at the back of the eye. The retina sends the information to the brain, which interprets what the eyes see.)

SCIENCE

EXPLAIN

(continued)

Recognizing the Rules of Light

Inform students recognizing what the parts of the eye do is just one part of understanding sight. They must also understand the rules of light. **Say:** *Light follows certain rules. It reflects, or bounces off of objects. It also refracts, or bends. And, light can be absorbed.* Explain to students that light appears to be white. But when it refracts we can see that it is actually made up of a rainbow of colors. The color we see depends on which light rays an object reflects and which ones it absorbs. **Ask:** *Why would a shirt look black?* (It absorbs all of the light rays.) *Why would it look white?* (It reflects all of the light rays.) *What would cause a shirt to look blue?* (It reflects blue light rays and absorbs the others.)

Recognizing Variations in Traits

Give each student a copy of the **Content Assessment Master**. Instruct students to draw a diagram of an eye and label its parts. Then display the **"Light Catchers" poster**. As you review the poster, challenge students to identify unique characteristics of each eye. Then have students select three animals from the article or poster. Instruct them to explain how each animal's eyes are unique.

ELABORATE

Find Out More

Display page 21 of the projectable magazine. Zoom in on the optical illusion at the bottom of the page. Review with students what an optical illusion is. Challenge them to explain why this one works. Then assign each student a partner. Invite pairs to find another optical illusion they like. Instruct them to conduct research to learn why the image causes people to see something that's not really there. Invite partners to share their results with the class.

Extend Your Thinking About Sight

Remind students that not all eyes are perfect. People can have trouble seeing close up or far way. Discuss how people can correct these problems. (contact lenses, glasses, surgery) **Ask:** *What do you think would happen to an animal with vision problems? Why?* Invite students to share their opinions.

EVALUATE

Have students record their answers to the assessment questions in their science notebooks or on a separate sheet of paper.

- *What causes people to be nearsighted?* (The eyeball is too long and light focuses before it reaches the retina. This causes people to have trouble seeing objects that are far away.)

- *What does a prism reveal about light?* (It reveals that light isn't white. It's composed of a rainbow of colors.)

- *How are nocturnal animals able to see well at night?* (They have large eyes with large pupils. This lets more light in.)

If you wish, have students complete the **Comprehension Check** to assess their knowledge of concepts mentioned in the article. You may also wish to examine the optional **Interactive Whiteboard** lesson that accompanies this article.

Name _____ Date _____

VOCABULARY ASSESSMENT: Seeing Eye to Eye

Record the definition of each vocabulary word. Create a sketch to help you remember what each word means.

Word	Definition	Sketch
focus		
reflect		
refract		
visible		
vision		

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Name _____ Date _____

LANGUAGE ARTS ASSESSMENT: Seeing Eye to Eye

Record five explicit statements about eyes from the text. Then combine information from the text with what you already know to make five inferences.

Explicit Statements
1. 2. 3. 4. 5.

What the Text Says	What I Already Know	Inferences I Can Make

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Name _____ Date _____

CONTENT ASSESSMENT: Seeing Eye to Eye

Draw a diagram of an eye. Label each part.

Identify three animals from the poster or article. Tell how each animal's eyes are unique.

Identify	Explain

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Name _____ Date _____

COMPREHENSION CHECK: Seeing Eye to Eye

Read each question. Fill in the circle next to the correct answer or write your response on the lines.

1. What is the colored part of the eye called?

   Ⓐ iris

   Ⓑ lens

   Ⓒ optic nerve

2. Which part of the eye sends a visual message to the brain?

   Ⓐ pupil

   Ⓑ cornea

   Ⓒ retina

3. Which type of animal has binocular vision?

   Ⓐ fish

   Ⓑ spiders

   Ⓒ birds of prey

4. What does binocular vision allow an animal to do?

   Ⓐ look in all directions

   Ⓑ see the same things two times

   Ⓒ see even when its eyes are closed

5. Identify three things light does. Tell how each affects what people see.

_____

_____

_____

_____

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Adventurer

ANSWER KEY

Kelp Kingdom

Assess Vocabulary, page 6
Students predicted definitions and sentences will vary. They should record the words and definitions from the Wordwise feature on page 9.

consumer: a living thing that eats other living things for food
decomposer: a living thing that breaks down wastes and remains of other organisms
ecosystem: all living and nonliving things in an environment and how they interact
keystone species: a species on which other species in an ecosystem depend
photosynthesis: the process of living things using sunlight to make food
producer: a living thing that makes its own food

Assess Language Arts, page 7
Students should record words and definitions from the Wordwise feature on page 9 of the article. (see above) They should identify examples, make connections between vocabulary words, and examine the information to reach conclusions related to a kelp forest. For **photosynthesis**, students should include examples of plants that conduct photosynthesis to make food.

Assess Content, page 8
Possible answers may include:

Producers: kelp, seaweed, bull kelp, giant kelp

Consumers: harbor seal, sea otter, fish, rockfish, grouper rockfish, feather duster worms, strawberry anemones, sea urchins

Decomposers: Kellet's whelk

Summary: Answers will vary, but students may note that consumers eat producers or other consumers. Decomposers eat things when they die. There are more types of consumers than producers.

Comprehension Check, page 9
1. B; 2. C; 3. C; 4: B; 5: Answers will vary but should include energy from the sun, a producer conducting photosynthesis, one or more consumers, and a decomposer.

Robot Revolution

Assess Vocabulary, page 14
Students should record the words and definitions from the Wordwise feature on page 15.

caregiver robot: a robot that provides care or comfort to patients
humanoid robot: a robot that looks like a human in some ways
robot: a machine that performs human tasks independently or imitates human actions
swarm robots: small robots that act together to do a job
technology: the use of science to solve problems or invent useful things

Students may arrange the words in various ways. The most logical organization is: row 1: technology; row 2: robot; and row 3: caregiver robot, humanoid robot, and swarm robots. This is logical because a robot is a type of technology. The three examples are types of robots.

Assess Language Arts, page 15
Possible responses: Pepper: anyone who needs a friend; Robo Sally: police or the military; ROSA: surgeons; Paro: patients in hospitals and nursing homes; Robobear: patients and their caregivers; swarm robots: search and rescue personnel, people who work in warehouses, farmers, people who work in mines or clean up oil spills

Quotes will vary but should be written from the perspective of the person using the robot.

Assess Content page, 16
Students should identify the six robots in the article: Pepper, Robo Sally, ROSA, Paro, Robobear, and swarm robots. Descriptions, function, and problems solved should be based on information in the text and photos.

Comprehension Check, page 17
1. A; 2. B; 3. C; 4: C; 5: Answers will vary depending on which robot students select.

ANSWER KEY

(continued)

Seeing Eye to Eye

Assess Vocabulary, page 22
Students should record the words and definitions from the Wordwise feature on page 23.

focus: to make a clear image in the eye
reflect: to send back light rays
refract: to bend light rays
visible: able to be seen
vision: sense of sight, or seeing

Sketches will vary depending on students' interpretations of each word. Evaluate each response for accuracy.

Assess Language Arts, page 23
Answers will vary. However, explicit statements should be facts quoted directly from the text. Inferences should be logical conclusions based on clues in the text and what students already know.

Assess Content, page 24
Students' diagrams should match the diagram on page 19 of the article. Examples will vary but should be based on information from the text or poster.

Comprehension Check, page 25
1. A; 2. C; 3. C; 4: B; 5: Possible response: Light reflects, refracts, and can be absorbed. When light reflects or is absorbed, it affects the colors people see. When it refracts, it can make things look like they are bent.