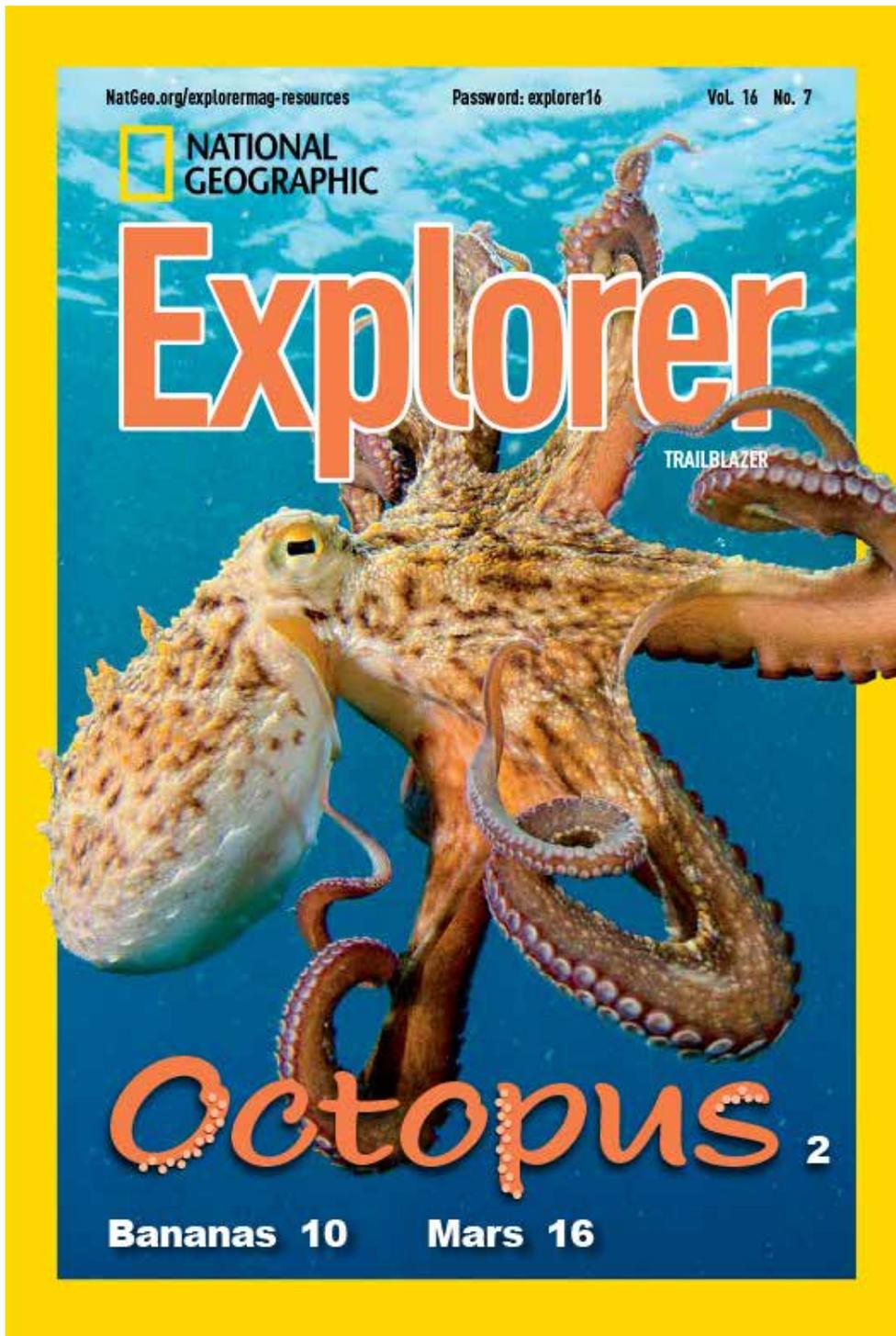


TEACHER'S GUIDE



Trailblazer (Grade 3)

Vol. 16 No. 7

In This Guide

This guide contains language arts and science lessons for articles in this issue of EXPLORER TRAILBLAZER.

Explorer Magazine

EXPLORER classroom magazines are specifically written for each grade, 2-5. Through great storytelling and stunning photographs, the EXPLORER magazines develop literacy skills and teach standards-based science content.

The EXPLORER magazines strive to offer a variety of reading experiences for students with different ability levels in the same class. Thus, all articles have been measured using the Lexile® Framework for Reading. Some articles will be easier to read than others, but all articles in EXPLORER TRAILBLAZER will be within the 350-750L range.

EXPLORER is part of NATIONAL GEOGRAPHIC EXPLORER'S Education program. For more resources, visit the "For Teachers" tab on EXPLORER'S website, natgeo.org/explormag-resources.

Your Subscription Includes:

- Magazines
- Classroom Posters
- Projectable Magazine
- Interactive Whiteboard Lesson
- Teacher's Guide
- App (additional subscription required)

Armed With Intelligence

LANGUAGE ARTS  LEXILE 610L

Objectives

- Students will use context clues to understand the meaning of unfamiliar words.
- Students will ask and answer questions before, during, and after reading the article.

Resources

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

Summary

- The article “Armed With Intelligence” takes students inside the world of the octopus. Readers learn how octopuses change shape, camouflage their bodies, and out-think predators to stay safe.

BUILD VOCABULARY AND CONCEPTS

- **cephalopod**
- **invertebrate**
- **neuron**

Display the vocabulary words. Inform students that using context clues such as the sentences before and after an unknown word or photographs on the page is a good strategy for understanding unfamiliar words that they come across as they read.

Give each student a copy of the **Vocabulary Assessment Master**. Invite volunteers to read aloud each vocabulary word. Then have students scan the article to locate each bold word within the text.

As a class, find and record text and photo clues from the article that are related to each vocabulary word. Brainstorm ideas about what each word means. Have students write a definition in their own words.

Invite volunteers to read aloud the definitions in the Wordwise feature on page 9 of the article. Encourage students to compare the definitions they wrote with those in the text. Discuss how context clues helped them understand each word.

READ

Let students know in this article is about octopuses. As they read, they will learn how octopuses change shape, camouflage their bodies, and out-think predators to stay safe.

Explain to students that good readers ask questions before, during, and after they read. They ask questions, in particular, when they encounter something they don't understand or something they want to learn more about. Usually, they can find the answer in the text.

Read aloud the headline and deck. **Say:** *This told me a lot about octopuses They are intelligent animals. They can change shape and color. They can out-think predators. Knowing this gives me part of an answer. But it also causes me to ask more questions. How do we know they're intelligent? How can they change shape and color? And what do they do to out-think their predators? To find the answers to those questions, I'll have to read the article.*

Give each student a copy of the **Language Arts Assessment Master**. Explain to student how they can use the worksheet to record questions and answers they have before, during, and after they read the article.

As a class, brainstorm a list of questions about the article. Instruct students to record the questions on their worksheets. Then have them read the article on their own. As they do, instruct them to record additional questions and any answers they find in the text. If students still have questions after reading the article, instruct them to record those questions, too.

Armed With Intelligence

LANGUAGE ARTS

TURN AND TALK

Have students turn and talk to discuss what they learned about octopuses. **Ask:** *Why is an octopus's body so flexible? (It doesn't have a spine.) What does this allow the octopus to do? (Change the shape of its body.) What else can an octopus change to protect itself? (the color and texture of its skin)* Encourage students to share other interesting facts they learned about octopuses and how they change their bodies to protect themselves.

- **Strengthen Understanding** Inform students that combining what you already know with what you learn can help readers understand new words. **Say:** *Once you understand what a word means, it's easier to use it correctly in a sentence.* Challenge students to make accurate statements using each of the vocabulary words. Encourage them to use their **Vocabulary Assessment Master** as a resource. Remind students to be original. They shouldn't restate sentences from the article. They should create new sentences of their own.

- **Ask and Answer Questions** Remind students that asking and answering questions is a strategy to help them understand what they read. **Say:** *Even the best readers come across words or ideas they don't understand. Asking questions is the first step toward figuring those things out. If you ask questions, you know which answers to search for as you read and re-read the text.* Have students share and compare their **Language Arts Assessment Masters** in small groups. Do they have the same questions? Did they find the same answers? If not, encourage them to identify where in the text they found the answer and make any corrections necessary.

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.

- *How do octopuses hide from their predators?*
- *What's special about an octopus's arms?*
- *What surprised you about what you read?*

Armed With Intelligence

SCIENCE

Objectives

- Students will recognize that the octopus is an ancient species.
- Students will understand how an octopus's body works.
- Students will compare and contrast different octopus species.

Resources

- Content Assessment Master (page 8)
- "Octopus!" poster (Teacher's Edition)
- Comprehension Check (page 9)
- "Armed With Intelligence" Interactive Whiteboard (optional)

Science Background

Octopuses are intelligent, solitary animals that live in the world's oceans. They are cephalopods, or a type of sea animal whose arms are attached directly to its head. An octopus has eight arms. Each arm is lined with hundreds of suckers.

Although some octopuses can be found in shallow waters, most live along the ocean floor. They emerge at night to search for their favorite foods, which include crabs, shrimps, and lobsters.

Because octopuses have no backbone, they can change the shape of their bodies. This allows them to squeeze through tight cracks. One species, the mimic octopus, changes its shape so it looks like other kinds of sea animals.

Octopuses are masters of disguise. In addition to changing shape, they can also change the color and texture of their skin. These abilities help keep octopuses safe from lurking predators.

ENGAGE

Tap Prior Knowledge

Draw a circle on the board. Draw eight lines coming off from the circle. Instruct students to write the name of the animal this drawing reminds them of. Then ask students to raise their hands if they wrote the word "octopus." Discuss reasons why. Invite students to share what they know about octopuses.

EXPLORE

Preview the Lesson

Display pages 2-3 of the projectable magazine. Zoom in on the deck. Point out the words *shape-shift*, *camouflage*, and *out-think*. Discuss what each word means. (to change shape/to disguise with color or pattern/to out-smart) **Say:** *According to the article, these are three things an octopus can do.* **Ask:** *Why do you think octopuses do these things?* (Students will most likely note that an octopus does these things to protect itself from predators.) **Ask:** *What do you think an octopus looks like or acts like when it does any of these things?* Invite students to share their ideas. Tell students that they will learn more about octopuses as they read the article.

Set a Purpose and Read

Have students read the article in order to recognize that the octopus is an ancient species, understand how an octopus's body works, and compare and contrast different octopus species.

EXPLAIN

Recognize How Octopus's Change Over Time

Display page 5 of the projectable magazine. Review the section "From Long Ago" with the class. Encourage students to compare the description of the octopus fossil with the image of the octopus on that page. **Ask:** *What clues tell historians that this is a fossil of an octopus?* (arms grouped together; rows of circles, or suckers, on each arm) Point out that it is rare to find a fossil of a soft-bodied animal. Challenge students to explain why. (Most fossils form around hard parts, like bones. Soft bodies usually leave no trace.)

EXPLAIN

(continued)

Understand How an Octopus's Body Works

Display page 6 of the projectable magazine. Zoom in on the diagram, "Octopus 101" and review the various body parts with the class. Discuss how an octopus's brain and arms work together to help it survive. **Say:** *The article tells about other ways an octopus's body helps it survive. An octopus can change shape, color, and texture to disguise itself from predators.* Display page 7 of the projectable magazine. Instruct students to look at the photo at the bottom of the page. **Say:** *Octopuses have soft bodies. One of the best ways for them defend themselves is to hide. Often, they hide in plain sight.* Point out that the octopus in this photo changed its color and skin texture to blend in with the rocks. Divide the class into small groups. Instruct groups to examine the photos on pages 8-9 of their student magazines. Have them discuss how the octopuses changed color, shape, and texture to blend in. Rejoin as a class to discuss the results.

Compare and Contrast Octopus Species

Display the Wordwise feature on page 9 of the projectable magazine. Discuss what a cephalopod is and why the octopus belongs in this group of animals. (An octopus has two main parts, the head and arms. Its arms are attached directly to its head.) Display the "**Octopus!**" poster. **Say:** *There are 300 species of octopuses. This poster shows five of them. As you can see, all five have arms attached directly to their heads. This is one thing they have in common. But there are also a lot of differences.* Review the poster with the class. Have students compare and contrast the octopuses they see. Then give each student a copy of the **Content Assessment Master**. Instruct students to select one octopus from the poster and another from the article. Challenge them to compare and contrast the two octopuses.

ELABORATE

Find Out More

Remind students that the article's headline mentioned intelligence. And throughout the article, the writer provided evidence to show that octopuses are smart animals. As a class, conduct research to find additional evidence that shows how intelligent octopuses are.

Extend Your Thinking About Octopuses

Instruct students to examine the photo at the bottom of page 7 in their student magazines. Point out that this octopus changed its color and texture to blend in with the reef. Then inform students that climate change is causing many coral reefs around the world to change. Higher water temperatures cause algae to grow inside the coral, making the reefs turn white. Obviously, this affects the coral. Discuss how it could also impact animals like octopuses, which disguise themselves to hide on coral reefs.

EVALUATE

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

- *What happens when an octopus relaxes or tightens muscles around tiny sacs beneath its skin? (It changes color.)*
- *Why do octopuses disguise themselves? (to blend in and hide from predators)*
- *What does an octopus's brain do? (make decisions and remembers things)*

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: Armed With Intelligence

Record information from the article about each vocabulary word .

Word			
Text Clues			
Photo Clues			
What I Think the Word Means			
Definition			

Name _____

Date _____

LANGUAGE ARTS ASSESSMENT: Armed With Intelligence

Record questions you have about octopuses before, during, and after reading the article.
Search for answers in the text.

	Questions	Answers
Before		
During		
After		

Name _____

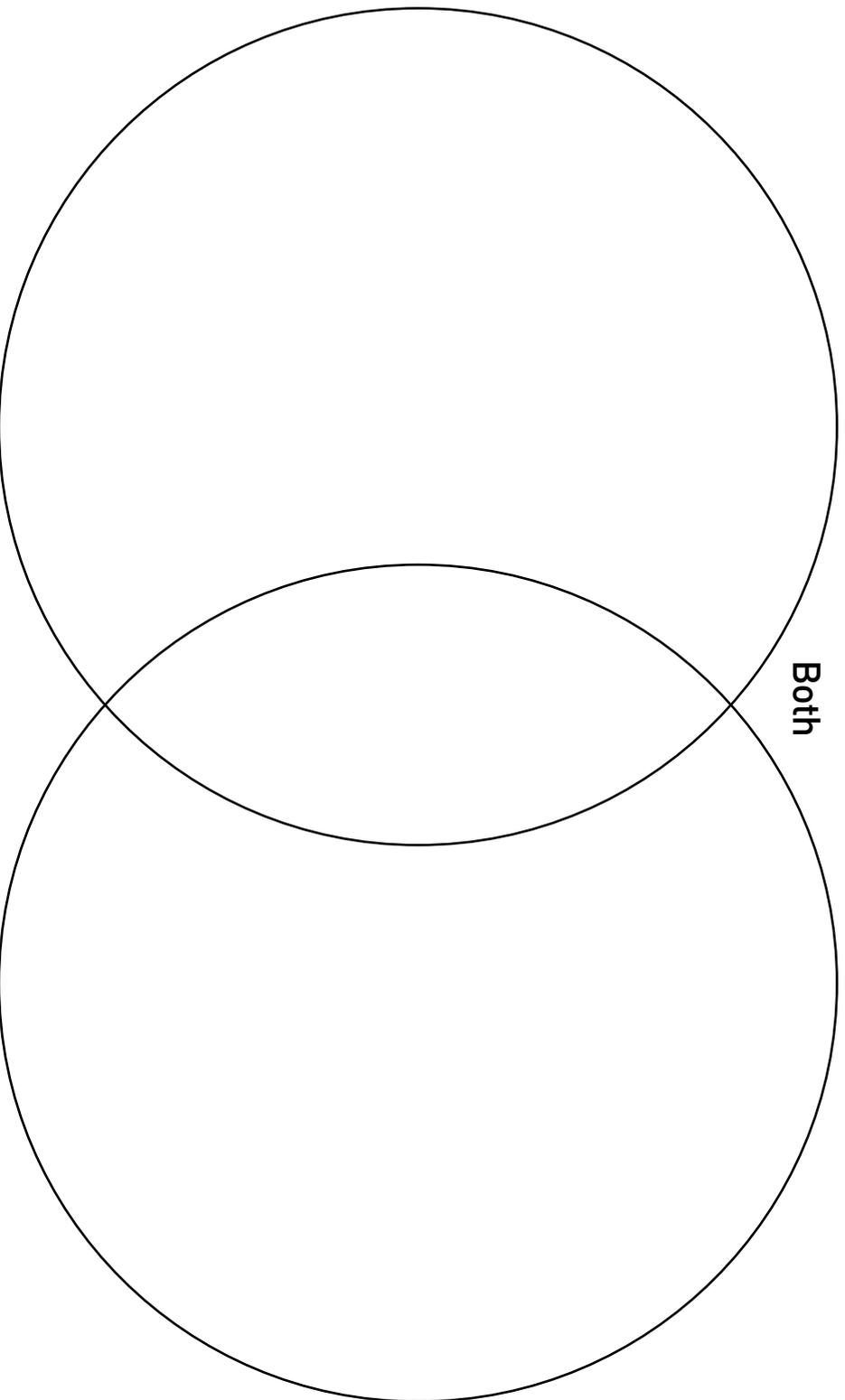
Date _____

CONTENT ASSESSMENT: Armed With Intelligence

Pick one octopus from the "Octopus!" poster and one from the article. Tell how they are alike and different.

Octopus: _____

Octopus: _____



COMPREHENSION CHECK: Armed With Intelligence

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

1. Why does a coconut octopus go inside coconut shells?
 - Ⓐ to eat coconut
 - Ⓑ to lay eggs
 - Ⓒ to hide

2. What are an octopus's arms lined with?
 - Ⓐ suckers
 - Ⓑ hair
 - Ⓒ ink

3. How do you know an octopus is an invertebrate?
 - Ⓐ It has eight arms.
 - Ⓑ It has no backbone.
 - Ⓒ It has a big head.

4. What do neurons do?
 - Ⓐ carry messages to the brain
 - Ⓑ contain pigments of color
 - Ⓒ reflect light

5. Describe one way an octopus changes color, shape, or texture to disguise itself.

Going Bananas!

LANGUAGE ARTS 620L

Objectives

- Students will record and define vocabulary words and create a diagram to show a logical connection between the words.
- Students will identify the main topic of a text.
- Students will recount key details and explain how they support the main idea.

Resources

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

Summary

- The article "Going Bananas!" reports on a fungus that could wipe out the banana population and explores potential solutions to the problem.

BUILD VOCABULARY AND CONCEPTS

- **clone**
- **fungus**
- **immune**
- **molecules**

Display the Wordwise feature on page 15 of the projectable magazine. Invite volunteers to read aloud the words and their definitions. Encourage students to share what they know about each word.

Give each student a copy of the **Vocabulary Assessment Master**. Instruct students to record each word and its definition. Brainstorm ideas about how the words could be connected. Then challenge students to create a diagram that illustrates a logical connection between the words. Invite students to share their ideas with the class.

READ

Give students a few minutes to scan the article in their magazines. **Then ask:** *What do you think this article is about? Why?* Encourage students to share their ideas.

Explain to students what they just attempted to identify was the main idea or overall topic of the article. Tell students that identifying the main idea of an article is important because the main idea tells readers what the article is about. To identify the main idea, they must search for clues. **Say:** *The most obvious place to find a clue is the article's headline. Sometimes it tells you exactly what the article is about. Other times it doesn't. When that happens, you have to search for more clues.*

Inform the class that good readers search for clues in the subhead, section heads, photos, and captions. If the article has a diagram or sidebar, those text elements can help, too. **Say:** *Articles are full of information. But some details are more important than others. These are the key details. Key details always support the main idea. They are the best clues to use when you're trying to figure out the main idea of the article.*

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 record important details in each section of the article. After reading, instruct students to use the details they collected to identify the main idea of the article. Challenge them to explain how the key ideas in each section supported the main idea of the article.

LANGUAGE ARTS

TURN AND TALK

Have students turn and talk to discuss what they learned about bananas. **Ask:** *What is the most common banana in the world?* (the Cavendish) *Where do bananas grow?* (in a band around Earth's middle) *Why are bananas in trouble?* (A fungus that kills banana plants is spreading around the world.) Invite students to share what else they learned about bananas.

- **Identify the Main Idea** Remind students that the main idea is the topic, or what something is about. Have students share their **Language Arts Assessment Masters** in small groups. Encourage them to compare the main ideas they recorded. Did they record the same main ideas? If not, have groups re-read the article so they can come up with a common response.

- **Support the Main Idea** Remind students that key details are important details in a text. They support the main idea of the text. Have students share their **Language Arts Assessment Masters** in small groups. Encourage groups to analyze how they thought each key detail supported the main idea of the article. Do all of the reasons make sense? If not, encourage students to reexamine the section involved to gain a better understanding of the text.

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.

- *In what ways is a banana the perfect fruit?*
- *How did the Cavendish become the most common banana in the world?*
- *What surprised you about what you read?*

Going Bananas!

SCIENCE

Objectives

- Students will understand what a clone is.
- Students will recognize the problem banana growers have and what is being done to solve it.

Resources

- Content Assessment Master (page 16)
- Comprehension Check (page 17)

Science Background

If you were to ask someone to name a yellow fruit, chances are they would say, "banana." And if you were to ask 10 people to draw a picture of a banana, chances are the pictures would all look the same. There's a reason for that. The banana you're most likely to buy at the market is a clone.

Although there are about thousand varieties of bananas on Earth, only one—the Cavendish—has a global reach. And each Cavendish banana has exactly the same genes. Most come from a single plant, which originated in Southeast Asia. In 1834, that plant was sent to William Cavendish, 6th Duke of Devonshire, who propagated its shoots to grow more bananas. The Cavendish came to dominate the world market when a deadly fungus killed other species. The Cavendish happened to be immune.

The banana is a monster of a fruit. It contains almost no fat and has been shown to lower the risk of heart attack and stroke, as well as the risk of getting some cancers. Bananas are the largest fruit crop and the fourth-most valuable food crop in the world. In the U.S. alone, people eat 3 million tons of bananas each year.

Despite its popularity, the banana is at risk of being wiped out. Another deadly virus, first discovered in Asia, is spreading across the globe. This time, the Cavendish is not immune. Although oceans separate the tropical areas where bananas grow, the fungus could be easily transported by people to a new location.

ENGAGE

Tap Prior Knowledge

Display two bananas from the same bunch. As a class, examine the properties of each. Note the bananas' color, shape, length, width, etc. Brainstorm ideas about why the two bananas are so much alike. (NOTE: Do not let any students with banana allergies handle the fresh fruits.)

EXPLORE

Preview the Lesson

Display pages 10-11 of the projectable magazine. Instruct students to imagine that they could take any two bananas in this bunch and have them switch places. **Ask:** *Would it make a difference? (no) Why? (The bananas are exactly alike.)* **Say:** *These bananas don't just look alike. They are alike in every way possible. That's because they're clones.* Tell students that they'll learn what clones are and why that could be a problem for bananas as they read the article.

Set a Purpose and Read

Have students read the article to understand what a clone is and recognize the problem banana growers have and what is being done to solve it.

Going Bananas!

SCIENCE

EXPLAIN

Understanding Clones

Display the Wordwise feature on page 15 of the projectable magazine. Review the definition of the word *clone*. Guide students to understand that clones don't just look alike. They are alike in every possible way. Divide the class into small groups. Have groups read and review the introduction on page 11 in their student magazines. Rejoin as a class. **Ask:** *How do bananas grow?* (They grow from small shoots, called suckers, that poke out from the plant's roots.) *Why is every single Cavendish banana a perfect clone of one another?* (Most of them come from a single plant that came from an island in the Indian Ocean.) *How is that possible?* (The plants they grow on come from suckers that were taken from that plant or plants that were grown from suckers taken from that plant.) Read aloud the Fast Fact at the bottom of the page. Point out that this process began in 1834, so there has been plenty of time for people to spread the Cavendish species all around the world.

Recognizing Problems and Solutions

Display pages 10-11 of the projectable magazine. Point out that while there isn't much text on this page, the words that are there identify the main idea of the article: A killer disease is threatening the world's supply of bananas, and banana growers are trying to figure out how to stop it. As a class, review the section "The Big Banana" on pages 12-13 of the article. **Say:** *This isn't the first time something has threatened the world's supply of bananas. The same thing happened in the 1950s. That fungus wiped out a kind of banana called the Big Mike. Give each student a copy of the **Content Assessment Master**. Instruct students to compare what happened to Big Mike in the 1950s with what is happening to the Cavendish banana now.*

ELABORATE

Find Out More

Display page 15 of the projectable magazine. Review the diagram, "Banana Choices," with the class. Then point out that these are only four types of bananas. There are 1,000 more, about 400 of which are edible. Divide the class into small groups. Instruct each group to conduct research to identify four other varieties of edible bananas. Encourage them to create a diagram like the one in the article that features the four varieties of bananas they found.

Extend Your Thinking About Bananas

Display page 13 of the projectable magazine. Zoom in on the diagram, "A Perfect Food?" Review the diagram with the class. Based on the information here, have students debate reasons why they think bananas are or are not the perfect food.

EVALUATE

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

- *How did being immune save the Cavendish banana in the 1950s?* (Being immune meant the Cavendish was resistant to the fungus that killed other bananas, like the Big Mike. The fungus couldn't kill the Cavendish.)
- *Why are all Cavendish bananas alike?* (They are clones. They come from the same plant so they have the same DNA.)
- *How does the new fungus kill Cavendish bananas?* (It causes the plant's leaves to shrivel up so the plant can't make food.)

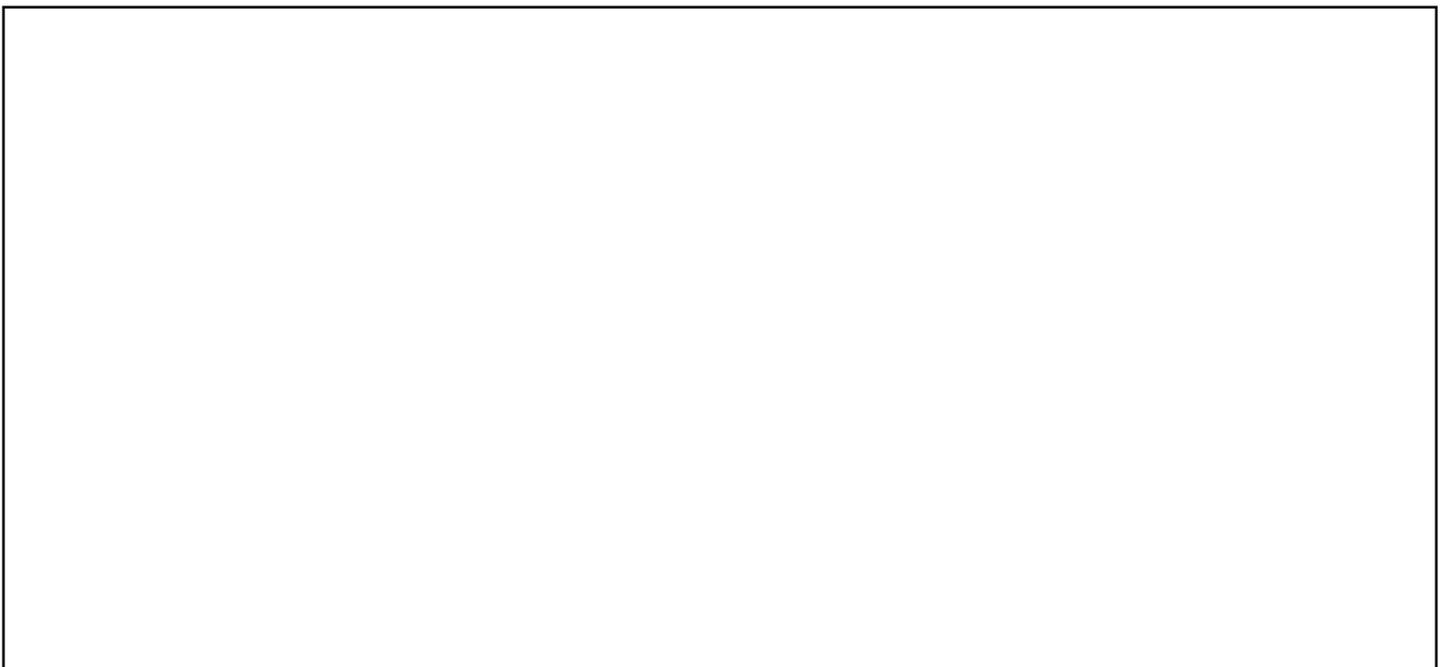
If you wish, have students complete the **Comprehension Check** to assess their knowledge of concepts mentioned in the article.

VOCABULARY ASSESSMENT: Going Bananas!

Record each vocabulary word and its definition.

Word	Definition

Create a diagram that shows a logical connection between the words.



LANGUAGE ARTS ASSESSMENT: Going Bananas!

Record key details from each section of the article. Identify the main idea. Tell how the key details in each section support the main idea.

Main Idea	
Key Details	How They Support the Main Idea
Introduction	
The Big Banana	
A New Threat	
What Happened?	
What to Do?	

Name _____

Date _____

CONTENT ASSESSMENT: Going Bananas!

Use this organizer to compare what happened to bananas in the 1950s to what is happening now.

	Big Mike/1950s	Cavendish/Now
What is or was the problem?		
What did people do or what are they trying to do to solve the problem?		
What happened, or what do you think will happen?		

COMPREHENSION CHECK: Going Bananas!

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

1. What killed the Big Mike banana in the 1950s?
 Ⓐ a bacteria
 Ⓑ a fungus
 Ⓒ a virus

2. What is killing the Cavendish banana today?
 Ⓐ a bacteria
 Ⓑ a fungus
 Ⓒ a virus

3. What are banana growers trying to do to solve the problem?
 Ⓐ grow more Cavendish bananas
 Ⓑ grow Big Mikes
 Ⓒ create a replacement banana

4. What do scientists want to create?
 Ⓐ a Cavendish banana that resists disease
 Ⓑ a Cavendish banana that grows further north
 Ⓒ a Cavendish banana with bigger leaves

5. Explain why all Cavendish bananas are alike.

Objectives

- Students will identify and investigate the definitions of unfamiliar words.
- Students will use various text features to locate key facts or information efficiently.

Resources

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

Summary

- The article "Mission to Mars" is a collection of infographics that explain how people could get to Mars, why the human body isn't built for space, and what people would need to survive on Mars.

BUILD VOCABULARY AND CONCEPTS

Display pages 22-23 of the projectable magazine. Point out that there is no Wordwise feature in this article. **Say:** *That doesn't mean that as you read the article you won't come across unfamiliar words.*

Give each student a copy of the **Vocabulary Assessment Master**. As students read the article, instruct them to record each word they find difficult to understand. **Say:** *These may be words you've never seen before or they may be words you do know that are used in a new way.*

Tell students to circle three words on their lists. Have them predict and write a definition for each word. Next, have them write a sentence using each word, based on the definitions they wrote. Then have students find each word in a dictionary and record its definition. If a word has multiple meanings, have students use context clues in the article to select the correct definition. Have students write a new sentence based on the definition they found.

Invite volunteers to identify the words they defined and read aloud the before and after sentences they wrote. As a class, examine how investigating definitions contributed to students' understanding of each word.

READ

Display pages 16-17 of the projectable magazine. Ask students which planet they are going to read about in this article. (Mars) Highlight the article's headline. **Ask:** *How many of you used the article's headline to answer my question? Guide the class to recognize that a headline is a text feature that helps readers locate key facts quickly.*

Point out that this article contains other text features that help in this way, too. Model how to identify and use text features to learn about a topic. **Say:** *Getting to Mars is very hard. And if people could get there, it would be hard for them to survive. They would have to wear special suits just to walk on the planet's surface. I know this because the deck tells me how dangerous it is. And the image shows me the special suit.*

Have students review the article to identify the headline, subheads, bold print, illustrations, diagrams, and sidebars. Discuss how each text feature can help readers get information quickly.

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 one key fact they learned from each type of text feature in the article.

LANGUAGE ARTS

TURN AND TALK

Have students turn and talk to discuss what they learned about space travel to Mars. **Ask:** *Why would it take a long time to reach Mars?* (Mars is 55 million kilometers [34 million miles] from Earth.) *What essential supplies would people need to take?* (air, water, and food) Encourage students to share other facts they learned about traveling to Mars as they read the article.

- **Predicting Definitions** Have students turn and talk to discuss what they learned about the three unfamiliar words they chose to investigate. 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.

- **Using Text Features** After reading the article, divide the class into small groups. Instruct students to ask each other questions about going on a mission to Mars. Encourage them to use the information they recorded on their **Language Arts Assessment Masters** to find the answers. Rejoin as a class. Discuss how using various text elements helped them quickly locate key information about traveling to and living on Mars.

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 kind of spacecraft is needed for people to travel to Mars?*
- *How could people survive living on Mars?*
- *What surprised you about what you read?*

SCIENCE

Objectives

- Students will compare and contrast the planets Earth and Mars.
- Students will understand how engineers are improving technology so people can travel to and live on Mars.

Resources

- Content Assessment Master (page 24)
- "Earth vs. Mars" poster (Teacher's Edition)
- Comprehension Check (page 25)

Science Background

Mars is the fourth planet from the sun. Its red surface is covered with loose dust and rocks. There are lots of volcanoes—one as wide as the state of New Mexico. And the planet's atmosphere is cold and thin. Liquid water cannot exist at the surface for any length of time.

Yet people want to go there. They want to live on Mars. And scientists are searching for ways to make that possible.

The first major obstacle is building a vessel able to take people all the way to Mars. No such spacecraft currently exists. But one is in the works. Once complete, it will be able to carry six astronauts 55 million kilometers (34 million miles) to Mars. The trip will take eight months.

That poses the second problem: surviving the journey. There is no way the spacecraft will be large enough to carry eight month's worth of supplies. So astronauts will grow their own food and recycle air and water. The spacecraft will use solar panels to collect energy from the sun.

Once the first settlers reach Mars—which could happen as early as the 2030s—they will need to build everything required to survive. If all goes as envisioned, their efforts could eventually grow into a self-sustaining colony capable of supporting up to a million people.

ENGAGE

Tap Prior Knowledge

Instruct students to imagine that they won a spot on the first mission to Mars. They've gone through extensive training. Now, it's time to pack for the trip. Space is limited so they're only allowed to take a few lightweight personal items. What would they take and why?

EXPLORE

Preview the Lesson

Display pages 16-17 of the projectable magazine. Invite volunteers to describe what they see in the image. **Ask:** *Does this image look like it shows an astronaut on Earth or Mars?* (Students will likely say Mars.) *Why?* (Possible responses: The astronaut is wearing a space suit. The land looks red. The sky looks orange.) *How do you know that this isn't actually a photo of an astronaut on Mars?* (Nobody has ever traveled to Mars...yet!) Brainstorm ideas about what life might be like if people could live on Mars.

Set a Purpose and Read

Have students read the article in order to compare and contrast Earth and Mars and understand how scientists use are improving technology so people can travel to and live on Mars.

EXPLAIN

Compare and Contrast Earth and Mars

Display the "**Earth vs. Mars**" poster. Focus on the "Moons and Size" section. **Ask:** *How do Earth and Mars compare in this respect?* (Earth is nearly twice as big as Mars, but Mars has twice as many moons as Earth.) Brainstorm ideas about how these differences might affect someone who lived on Mars. (Possible responses: It would take twice as long to travel around the planet. The night sky might be brighter because there are two moons.) Review the other sections of the poster in this same way. Guide discussion as students compare and contrast what it would be like to live on Earth vs. Mars.

SCIENCE

EXPLAIN

(continued)

Understanding the Need for New Technology

Display pages 18-19 of the projectable magazine. Read aloud the text under the subhead "A Long Journey." Guide students to understand that the spacecraft they see here doesn't exist yet. The drawing is a model of the type of spacecraft that engineers think will work. **Say:** *Building a suitable spacecraft is one obstacle. Surviving on Mars is another. Engineers have to solve all of these problems before people go to Mars. Otherwise, the people could not survive.* Divide the class into small groups. Instruct each group to pick one problem people would face if they lived on Mars. Have them and brainstorm ideas for a new product that could solve that problem. Give each student a copy of the **Content Assessment Master**. Have students describe the problem. Then instruct each student to draw his or her own vision of that new technology.

ELABORATE

Find Out More

Inform students that Elon Musk, founder and CEO of SpaceX, has laid out plans for establishing the first human settlement on Mars. Some of the information presented in this article relates to his ideas. Divide the class into small groups. As a class, conduct research to learn more about Musk and his vision. Then, have a class debate about Musk's vision and its potential for success.

Extend Your Thinking About Living on Mars

Display pages 22-23 of the projectable magazine. As students examine the image, instruct them to really think about what it would be like to live on Mars.

Ask: *Based on what you see, would you like to live on Mars or not?* Encourage 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 is a "green wall"?* (a vertical garden on a wall where people grow food)
- *Why do astronauts in space grow taller?* (Without the pull of Earth's gravity, the spine can expand and relax. This makes astronauts "grow" while they're in space.)
- *What is the first thing people would need to do if they went to Mars?* (They would need to build a short-term shelter that could recycle all of their water, air, and waste.)

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

VOCABULARY ASSESSMENT: Mission to Mars

Record unfamiliar words from the article. Circle three words on the list.
Use the organizer to investigate the meaning those words.

Unfamiliar Words			
Word			
Predicted Definition			
Sentence			
Dictionary Definition			
Sentence			

LANGUAGE ARTS ASSESSMENT: Mission to Mars

Record one key fact you learned from each type of text feature in the article.

Text Feature	Fact
headline	
subhead	
bold print	
illustration	
diagram	
sidebar	

Name _____

Date _____

CONTENT ASSESSMENT: Mission to Mars

Describe a problem people would face if they lived on Mars.

Draw a picture of a new product that could solve that problem.



COMPREHENSION CHECK: Mission to Mars

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

1. Where in the spacecraft would astronauts stay while traveling to Mars?

- Ⓐ the crew vehicle
- Ⓑ the habitat module
- Ⓒ the Mars descent vehicle

2. What would astronauts use "green walls" to make?

- Ⓐ radiation
- Ⓑ food
- Ⓒ shelter

3. Which of these "favorite things" has an astronaut taken into space?

- Ⓐ Legos
- Ⓑ Eggos
- Ⓒ eggs

4. What happens to a person's body while in space?

- Ⓐ It grows.
- Ⓑ It shrinks.
- Ⓒ It doesn't change.

5. Describe three ways Earth is different from Mars.

ANSWER KEY

Armed With Intelligence

Assess Vocabulary, page 6

Students should record the words and definitions from the Wordwise feature on page 9.

cephalopod: a sea animal that has tentacles attached to its head, like an octopus or squid

invertebrate: an animal without a backbone

neuron: a cell that carries information usually between the brain and other parts of the body

Text clues, photo clues, and what students think each word means may vary. Evaluate answers for accuracy.

Assess Language Arts, page 7

Students' questions will vary, but all questions should relate to the article. All answers should come directly from the text.

Assess Content, page 8

Answers will vary depending on which octopuses students select. One of the selections should come from the "Octopus!" poster. The other should come from the article.

Comprehension Check, page 9

1. C; 2. A; 3. B; 4. A; 5: Answers will vary but students should give a detailed description of one way an octopus disguises itself by changing its color, shape, or texture.

Going Bananas!

Assess Vocabulary, page 14

Students should record the words and definitions from the Wordwise feature on page 15.

clone: to grow an identical plant or animal from the cells of another plant or animal

fungus: a plant-like organism that has no leaves, flowers, roots. It grows on other plants or decaying matter.

immune: resistant to a particular infection or disease

molecules: the smallest particle of a substance with the same properties of that substance

Diagrams should show a potential relationship between the vocabulary words.

Assess Language Arts, page 15

As the main idea, students should note that a killer disease is threatening the world's supply of bananas and growers are trying to stop it. Key details, by section, should focus on: clones; the fungus that killed Big Mike; the current threat to the Cavendish; how the new fungus works; and what growers and scientists are doing to stop it. Students should identify a logical reasons explaining why each detail supports the main idea of the text.

Assess Content page, 16

Possible responses include:

(1950s) Problem: A fungus was attacking the roots of banana plants. Solutions: Growers tried to kill the fungus with chemicals. Outcome: The fungus wiped out Big Mike and the Cavendish became the most common banana.

(Now) Problem: A fungus is attacking the leaves of Cavendish banana plants. The leaves shrivel up and the plants cant make food so they die. Solutions: Growers are trying to create a replacement banana. Scientists are trying to create a Cavendish that is resistant to disease. Outcomes: Student answers will vary.

Comprehension Check, page 17

1. B; 2. B; 3. C; 4: A; 5: All Cavendish bananas are alike because they're clones. They all trace back to the same plant.

ANSWER KEY

(continued)

Mission to Mars

Assess Vocabulary, page 22

All unfamiliar words must appear in the article. Predicted definitions and sentences will vary. Students may use a printed or online dictionary to find each word's actual definition.

Assess Language Arts, page 23

Students should record one fact from the article directly related to each text feature.

Assess Content, page 24

Students should describe one problem people would face living on Mars. Possibilities include obtaining shelter, food, water, and air. They should draw a detailed picture of a new product they think will solve that problem.

Comprehension Check, page 25

1. B; 2. B; 3. A; 4: A; 5: Answer will vary. Students might note differences identified on the "Earth vs. Mars" poster.