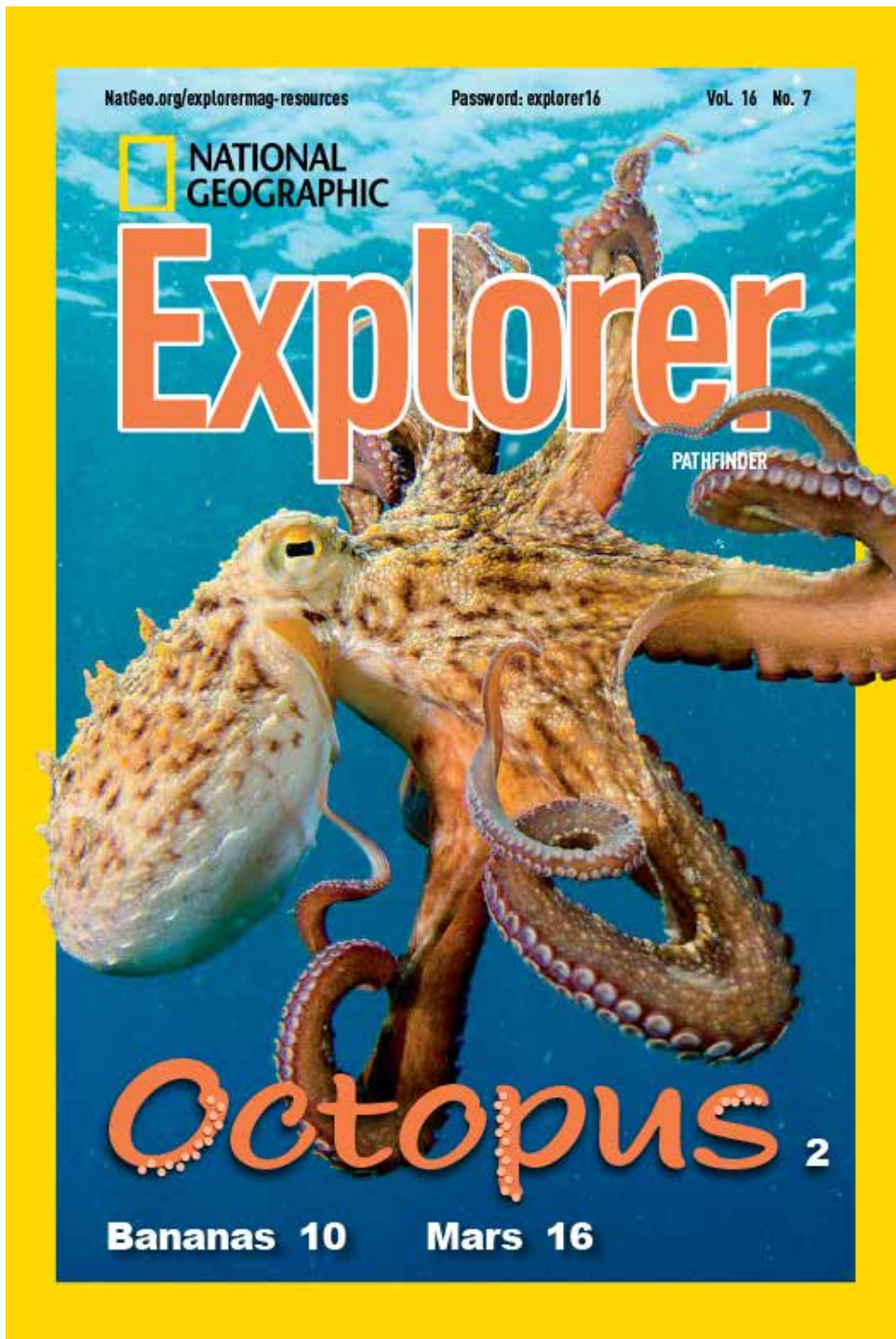


# TEACHER'S GUIDE



Pathfinder (Grade 4)

Vol. 16 No. 7

## In This Guide

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

## 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 PATHFINDER will be within the 450-850L range.

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# Armed With Intelligence

LANGUAGE ARTS  LEXILE 670L

## Objectives

- Students will use context clues to understand the meaning of unfamiliar words.
- Students will identify explicit statements and make inferences about the text.

## 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**
- **mollusk**
- **neuron**

Display the vocabulary words on a word wall or on the whiteboard. 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.

Give each student a copy of the **Vocabulary Assessment Master**. Instruct students to record each vocabulary word from the article. Have them scan the article to locate each bold word in the text.

Tell students to record text and photo clues from the article that are related to each vocabulary word. Then instruct each student to record his or her own idea about what each word means. 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 to understand the meaning of 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.

Tell students that as they read, they will come across many facts that are stated clearly in the text. These facts are explicit statements. But they will also encounter clues that require them to make an educated guess, or inference. To do this, they must combine what the text says with what they know to reach a logical conclusion.

Display pages 2-3 of the projectable magazine. Instruct students to examine the photo. Read aloud the headline. Then model how to make inferences. **Say:** *When I look at this photo, I can easily guess, or infer, why the writer chose to use the word armed in the headline. I know that an octopus has eight arms. It makes sense that the writer would mention all of those arms in the headline. Point out, however, that the word armed has another definition: "to have a means of providing protection or strength." **Say:** Using that definition, I can infer that an octopus protects itself with its intelligence. But how does it do that?*

Zoom in on the deck and read it aloud. Then model how to identify explicit statements. **Say:** *Here it says that an octopus can shape-shift. It can camouflage. It can also out-think predators. Each of these sentences is an explicit statement. The writer tells you exactly what the octopus does. To more about these abilities and other ways an octopus protects itself from predators, I'll need to read the rest 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, have them write five explicit statements and make five inferences that tell how octopuses protect themselves from predators.

# 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.

- **Make Inferences** Remind students that making inferences is a strategy to help them understand what they read. **Say:** *Understanding what you just read is important. But interpreting information from a writer's clues takes practice. If you can't follow the clues, you might need to reread the text.* Have students compare their **Language Arts Assessment Masters** with a partner. Did students identify the same explicit statements? Did they find the same clues? If so and they developed different inferences, encourage students to review the text once again. Challenge them to explain to their partners how the clues they found created a path of knowledge that helped them each reach logical conclusion.

### 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.

- *Why does the writer say that the octopus is an intelligent animal?*
- *The writer calls octopuses "masters of disguise." Why do you think that is?*
- *What surprised you about what you read?*

# Armed With Intelligence

## SCIENCE

### Objectives

- Students will recognize how an octopus's physical features help it blend in.
- Students will examine how an octopus's body systems help it survive.
- 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 how an octopus's physical features help it blend in, examine how its body systems help it survive, and compare and contrast different octopus species.

### EXPLAIN

#### Recognize How an Octopus Blends In

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.

### EXPLAIN

(continued)

#### Examine Octopus Body Systems

Display page 6 of the projectable magazine. Zoom in on the diagram, "Octopus 101" and review the various body parts with the class. **Ask:** *Which body system does this diagram tell the most about? (nervous system) What does the nervous system do? (process information) Which parts of an octopus's body are related to the nervous system? (arms, brain, nerves, neurons) How do those parts work together? (Neurons are cells of the nervous system. They are located in the arms and brain. Bundles of neurons, called nerves, control movement in the arms. They also gather information to send to the brain.)* Point out that there are no bones in this illustration.

**Ask:** *Why? (An octopus is an invertebrate. It has no skeletal system.)* Discuss how NOT having a skeletal system helps an octopus survive. (Not having bones allows the octopus to change shapes and squeeze into small spaces.)

#### Compare and Contrast Octopus Species

Display the Wordwise feature on page 9 of the projectable magazine. Challenge students to explain how the words *mollusk* and *cephalopod* are related. (A mollusk is a type of animal. A cephalopod is a type of mollusk.) Inform students that they classify octopuses even further, they will eventually reach the species level. Display the **"Octopus!" poster**.

**Say:** *There are 300 species of octopuses. This poster tells about five.* Review the poster with the class.

Challenge students to identify distinguishing characteristics of each octopus. Then give each student a copy of the **Content Assessment Master**. With a partner, have students select one species of octopus from the chart. Then have them conduct research to identify and learn about two more. Instruct students to compare and contrast the three octopuses. Have partners share what they learned with the class. Challenge students to recognize common traits found in all octopuses. Encourage them to also identify unique differences they see.

### ELABORATE

#### Find Out More

Remind students that the headline mentioned intelligence. Throughout the article, the writer provided evidence to show that octopuses are smart. Divide the class into small groups. Instruct groups to conduct research to find additional evidence that shows how intelligent octopuses are. Invite students to share what they learned with the class.

#### 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.

- *How does an octopus change its color? (It relaxes or tightens tiny muscles on its skin.)*
- *How did the mimic octopus get its name? (It changes its body shape to mimic the shape of other animals, like the mantis shrimp, sea snake, and sole.)*
- *What does the algae octopus change to blend in? What does it look like when it does this? (the texture of its skin; a piece of algae)*

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				

## LANGUAGE ARTS ASSESSMENT: Armed With Intelligence

Record five explicit statements and make five inferences that tell how octopuses protect themselves from predators.

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

### Inferences

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

Name \_\_\_\_\_

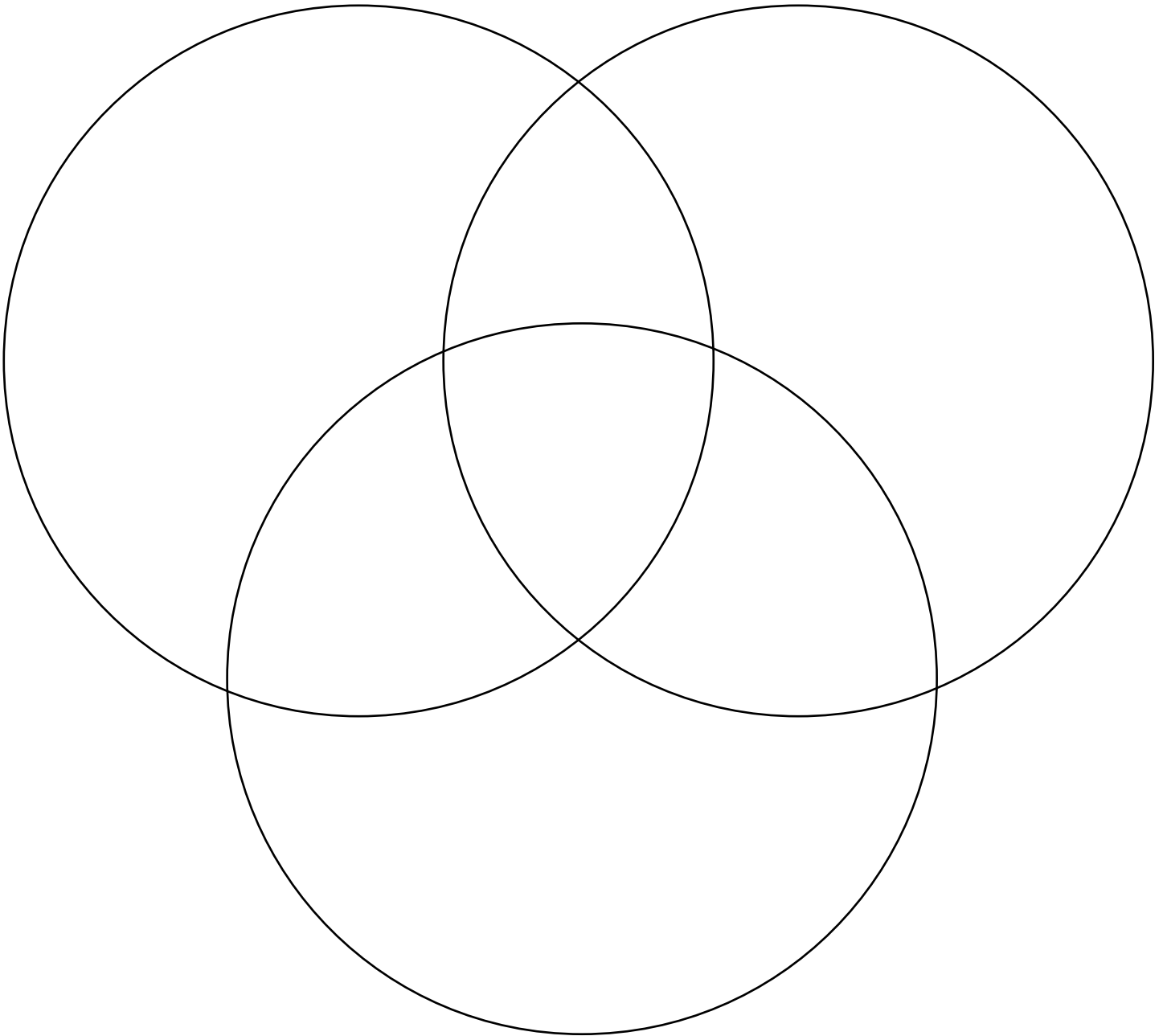
Date \_\_\_\_\_

## CONTENT ASSESSMENT: Armed With Intelligence

Pick one octopus from the "Octopus!" poster. Find two more octopus species. Compare and contrast their traits.

Octopus: \_\_\_\_\_

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. How did the coconut octopus get its name?  
 Ⓐ Its skin feels like a coconut.  
 Ⓑ It likes to hide inside coconuts.  
 Ⓒ It is shaped like a coconut.
2. What does an octopus's nervous system do?  
 Ⓐ process information  
 Ⓑ make the octopus nervous  
 Ⓒ squirt ink
3. Which of these words can be used to describe an octopus?  
 Ⓐ vertebrate  
 Ⓑ squid  
 Ⓒ cephalopod
4. Which of these statements is true?  
 Ⓐ Neurons help an octopus solve problems.  
 Ⓑ Most of an octopus's neurons are in its brain.  
 Ⓒ Neurons are part of the octopus's skeletal system.
5. Describe one way an octopus changes color, shape, or texture to disguise itself.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

# Going Bananas!

## LANGUAGE ARTS 610L

### Objectives

- Students will record and define vocabulary words and create a diagram to show a potential relationship between the words.
- Students will identify the main idea of the article, the introduction, and each section.
- Students will summarize the article.

### 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
- DNA
- fungus
- gene
- immune

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 potential relationship 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. Everything in the article is connected to the main idea. Each section has a main idea, too. Everything in a section is connected to the main idea of that section.

Display pages 10-11 of the projectable magazine. Model how to identify the main idea of the article.

**Say:** *Looking at this photo, it's pretty easy to guess what this article is about: bananas. But what will it tell me about bananas? What is the main idea? Is this article about the history of bananas? Is it a collection of recipes for banana desserts? Without more information, it's impossible to know.* Highlight the two lines of text on the bananas. Read them aloud.

**Say:** *These two sentences are great clues. The first sentence tells me that bananas are a huge food source for people. The second one tells me that this food source is threatened.*

Point out the comprehension strategy in the upper left corner. Read it aloud. **Say:** *It would have been easy to miss this final clue. But that would have a mistake. Because I would have only know part of the main idea. Now I get a complete picture: A killer disease is threatening the world's supply of bananas, and scientists are working to find a solution.*

Have students read the article on their own. As students read, encourage them to search for details that support the main idea of the article.

# Going Bananas!

## 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 equator) 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 Main Ideas** Remind students that the article has a main idea. But each section has its own main idea, too. Explain that they can find the main idea of a section the same way they found the main idea of the article. They search for important clues. Give each student a copy of the **Language Arts Assessment Master**. Instruct students to write the headline and record the main idea of the article. (A killer disease is threatening the world's supply of bananas, and scientists are working to find a solution.) Then assign each student a partner. Have pairs record the name of each section and skim the text to determine the main idea of each. Once students are finished, challenge them to analyze the information and write a brief summary of the article.

- **Summarize the Text** Tell students that summarizing an article is also a good strategy to check their understanding. **Say:** *When you summarize, you restate the major ideas of the article in your own words. If you are unable to do this, you may not fully understand what you read.* Have students turn and talk with a partner to share the summaries they wrote on their **Language Arts Assessment Masters**. If partners find that their summaries are vastly different, encourage them to review the article together, analyze each summary, and rewrite one or both of their ideas.

### 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.

- *Bananas have been described as the "perfect food." Why?*
- *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 how scientists have identified a problem with bananas and are working to find a solution.

### 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 how scientists have identified a problem with bananas and are working to find a solution.

## 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 originated in Southeast Asia.) *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 around the world.

#### Recognizing Problems and Solutions

Display pages 10-11 of the projectable magazine. Remind students that they used the information on these pages to identify the main idea of the article: A killer disease is threatening the world's supply of bananas, and scientists are working to find a solution. Then have students read and review the section "The Big Banana" on pages 12-13 of the article. **Say:** *Unfortunately, this isn't the first time something has threatened the world's supply of bananas. The same thing happened in the 1950s.* Give each student a copy of the **Content Assessment Master**. Instruct students to describe the problem bananas faced in the 1950s and the threat they face now. Have them record the solutions people came up with. Then have them identify the solution they like best and explain why they think it could be a long-term solution to the problem bananas face.

### 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.

- *Why can't a fungus affect bananas that are immune to it?* (If the bananas are immune, they are resistant to that particular fungus. It can't make them sick.)
- *Why are all clones alike?* (They come from the same plant so they have the same DNA.)
- *Where do bananas grow?* (Bananas grow in a range above and below the equator.)

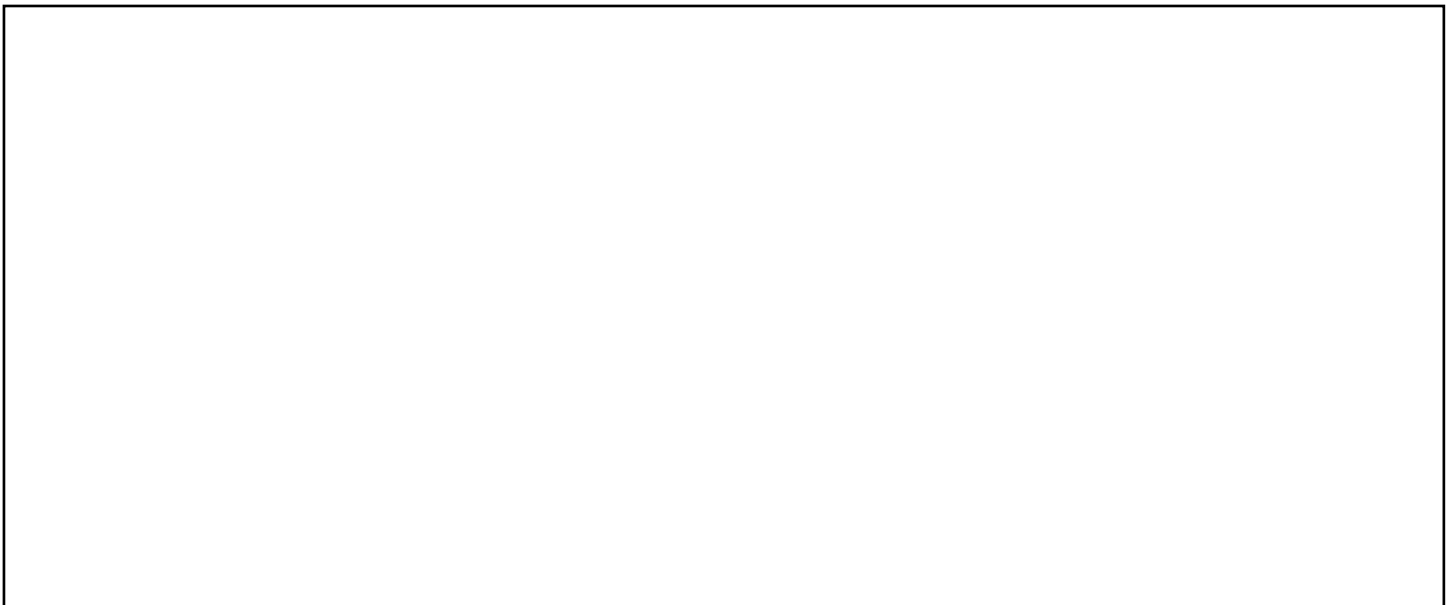
If you wish, have students complete the **Comprehension Check** to assess their knowledge of concepts mentioned in the article.

**VOCABULARY ASSESSMENT: Going Bananas!**

Record each vocabulary word and its definition.

Word	Definition

Create a diagram that shows a potential relationship between the words.



## LANGUAGE ARTS ASSESSMENT: Going Bananas!

Record the headline and main idea of the article, the introduction, and each section. Summarize the text.

Article Headline	Main Idea
Section Subhead	Main Idea
Introduction	

### Summary

Name \_\_\_\_\_

Date \_\_\_\_\_

**CONTENT ASSESSMENT: Going Bananas!**

Describe the problems facing bananas in the 1950s and now. Record the solutions people found.

	1950s	Now
Problem		
Solution		

**Pick the solution you like best. Tell why you think it could work long-term.**



**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 is the most common banana in the world?  
Ⓐ the Cavendish  
Ⓑ the Culpepper  
Ⓒ the Carthage
  
2. What killed the Big Mike bananas in the 1950s?  
Ⓐ a bacteria  
Ⓑ a fungus  
Ⓒ a virus
  
3. What is killing bananas today?  
Ⓐ a bacteria  
Ⓑ a fungus  
Ⓒ a virus
  
4. In which of these countries are bananas grown?  
Ⓐ Canada  
Ⓑ England  
Ⓒ Ecuador

5. Explain how a banana can be a clone.

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# Mission to Mars

LANGUAGE ARTS  LEXILE 690L

## Objectives

- Students will identify and investigate the definitions of unfamiliar words.
- Students will use information in the article to explain what scientists are doing to solve problems so humans can survive in space.

## 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. Instruct students to examine the image. Then invite a volunteer to read aloud the headline and deck. Invite students to share their thoughts on the deck.

Inform students that space travel is dangerous. The purpose of this article is to help them understand how scientists are making it possible for humans to get to and survive living on Mars.

**Say:** *Before people can go to Mars, scientists have to understand all of the obstacles space travelers face. In other words, what are the problems? Then they work on solutions. This takes time. After all, you can’t just go into outer space to conduct experiments on a whim.*

Scan the article with the class. Guide students to recognize that the article covers three main topics: getting to Mars, living in space, and how to survive once you reach Mars.

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 summarize the main problem addressed in each section. Then have them write a detailed explanation about what scientists are doing to help people overcome each obstacle.

## LANGUAGE ARTS

### TURN AND TALK

Have students turn and talk to discuss what they learned about space travel to Mars. **Ask:** *How long would it take astronauts to reach Mars? (eight months) Why would it take so long? (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.

- **Explain Concepts** Point out to students that when they read articles on scientific topics, they may encounter situations that present multiple problems and/or solutions. But just because the information is complex doesn't mean it has to be difficult to understand. **Say:** *The best way to figure things out is to ask questions as you read. What happened? Why did it happen? How is one thing related to another? You can usually find the answer to each of your questions right there in the text.* Point out that a good way to test your understanding of a topic is to try to explain the ideas to someone else. **Say:** *If you can't explain the concept, you might need to read the article again.* Have students turn and talk to share their **Language Arts Assessment Masters** with a partner. Can they state the problems clearly? Do their explanations of solutions make sense? If not, instruct partners to reread the text and revise their responses accordingly.

### 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.

- *Why is space dangerous for humans?*
- *How could people survive living on Mars?*
- *What surprised you about what you read?*

# Mission to Mars

## SCIENCE

### Objectives

- Students will compare and contrast the planets Earth and Mars.
- Students will understand how scientists use models to represent events and design solutions.
- Students will recognize obstacles that make it difficult for people to communicate between Earth and 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 2.2 kilograms (5 pounds) of 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, understand how scientists use models to represent events and design solutions, and recognize obstacles that make it difficult for people to communicate between Earth and 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 How Scientists Use Models

Display pages 18-19 of the projectable magazine. Review the line-art drawing of the spacecraft at the top of page 18. **Ask:** *How can you get a better idea of what it's like inside this spacecraft?* (Look at the larger drawing. They're the same thing.) Point out that the numbers on the larger drawing correspond with the numbers in the key at the bottom of the page. Explain to the class that scientists use models like these to represent their design solutions.

Display pages 22-23 of the projectable magazine.

**Say:** *Not all models are simple. This illustration is a model, too. It shows and explains what a community on Mars might look like.* Give each student a copy of the

**Content Assessment Master.** Instruct each student to draw a model of something else mentioned in the article. Examples could include a green wall garden, a close-up of the crew's living or work spaces, or a mechanism that makes air or water from Martian natural resources. Tell them to include enough details and information for readers to easily understand how the object works.

#### Communicating With People on Mars

As a class, brainstorm a list of ways people on Earth communicate with one another. **Ask:** *Do you think these same methods of communication would work if the person you wanted to talk to was on Mars?*

As students share their opinions, guide them to recognize that the technology to communicate with people on Mars does exist. **Say:** *Your voice would just have to be transmitted as digitized information.*

*The message you sent would then be decoded so it sounded like your voice when it reached Mars.* Have students write a list of questions they would like to ask the first astronauts who travel to Mars.

Using information in the article as a starting point, challenge classmates to write accurate answers to each question.

### 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. Instruct groups to conduct research to learn more about Musk and his vision. Based on what they learn, encourage students to write a brief essay expressing their opinions on Musk and his 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.)
- *How could people breathe if they lived on Mars?* (They could make air by using carbon dioxide from Mars' atmosphere.)

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			
<b>Word</b>			
<b>Predicted Definition</b>			
<b>Sentence</b>			
<b>Dictionary Definition</b>			
<b>Sentence</b>			

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Name \_\_\_\_\_

Date \_\_\_\_\_

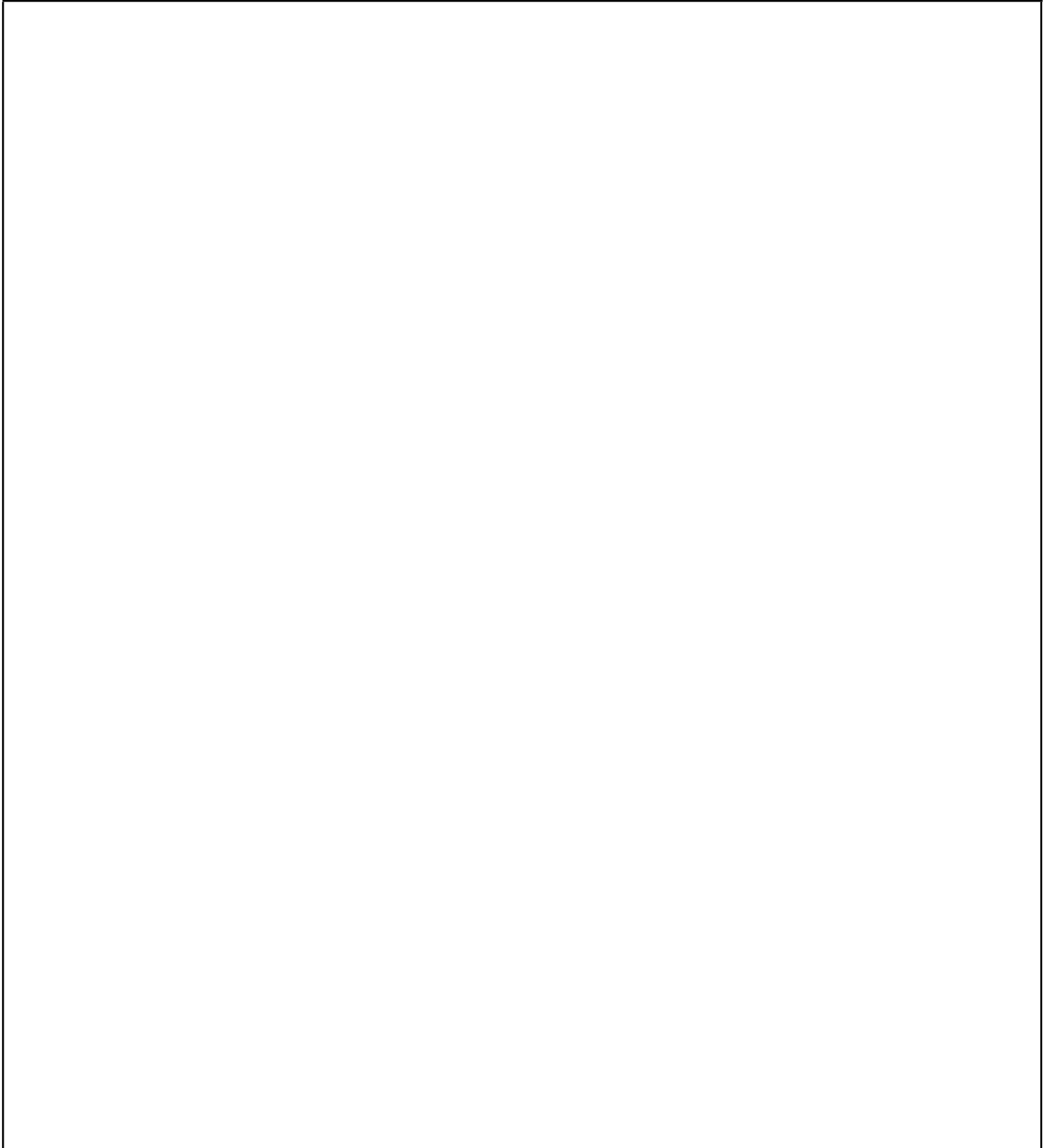
**LANGUAGE ARTS ASSESSMENT: Mission to Mars**

Summarize the problems identified in each section of the article. Write detailed explanations to tell what scientists are doing to solve the problems.

	Getting There	Life in Space	On Mars
Problems			
Solutions			

## CONTENT ASSESSMENT: Mission to Mars

Create a detailed model of something people would need to survive on Mars. Number important parts of the model. Include a key that explains what each number represents.





**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. Which of these is an essential item astronauts need to survive a trip to Mars?

- Ⓐ lightsabers
- Ⓑ Legos
- Ⓒ air

2. How long would it take for a spacecraft to reach Mars?

- Ⓐ eight months
- Ⓑ 500 days
- Ⓒ two weeks

3. How would "green walls" protect astronauts on the spacecraft?

- Ⓐ They would repel aliens.
- Ⓑ They would detect space junk.
- Ⓒ They would block radiation.

4. Which of these statements is true?

- Ⓐ The human body isn't built for space.
- Ⓑ The human body changes very little in space.
- Ⓒ The human body is healthier in space.

5. Describe three ways Earth is different from Mars.

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## 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

**mollusk:** an animal with a soft body, no spine, and usually a hard shell that lives in the water or a damp habitat, like a snail or an oyster

**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 should record five explicit statements and make five inferences related to how octopuses protect themselves from predators. Inferences may vary but should be logical and directly relate to information in 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. Students should identify distinct traits of each species as well as traits all species share.

#### Comprehension Check, page 9

1. B; 2. A; 3. C; 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

**DNA:** the molecule that carries genes, found inside the nucleus of cells

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

**gene:** a segment of DNA that holds instructions for producing a protein. Offspring inherit genes from their parents. Genes influence how an organism looks and behaves.

**immune:** resistant to a particular infection or disease

Diagrams should show a potential relationship between the vocabulary words.

#### Assess Language Arts, page 15

Students should record the article headline and each subhead. Information regarding main ideas should accurately reflect the content of each section.

#### Assess Content page, 16

Possible responses include:

(1950s) Problem: A fungus attacked the roots of banana plants; Solutions: Growers treated plants with chemicals. It didn't work. They now grow the Cavendish, which is immune to the fungus.

(Now) Problem: A fungus is attacking banana leaves. The leaves wilt and shrivel up. The plant can't make food. Solutions: Growers are crossing existing bananas to make a new kind that is immune to the fungus. Bioengineers are trying to manipulate genes in a lab to make the Cavendish resistant to disease.

Answers to the third part will vary, depending upon which solution students choose to support.

#### Comprehension Check, page 17

1. A; 2. B; 3. B; 4. C; 5: A plant produces bananas. Small shoots, or suckers, poke out from the plant's roots. Growers harvest the bunch and cut down the main plant. The suckers sprout new bunches of identical bananas on the same plant.

(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

Answers will vary as there are many different problems and solutions to choose from in each section. However, students should outline a detailed solution for each problem identified.

#### Assess Content, page 24

Students models will vary. However, students should number important parts in their diagrams and include a key that explains what the number mean.

#### Comprehension Check, page 25

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