

TEACHER'S GUIDE

Pioneer (Grade 2)

Vol. 16 No. 7



In This Guide

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

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 PIONEER will be within the 250-550L range.

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

Armed With Intelligence

LANGUAGE ARTS  470L

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**
- **predators**

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 trick 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 trick 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 soft? (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 of its skin and what its skin feels like)* 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.

- *What does an octopus look like?*
- *What's special about an octopus's arms?*
- *What surprised you about what you read?*

Armed With Intelligence

SCIENCE

Objectives

- 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 understand how an octopus's body works and to compare and contrast different octopus species.

Armed With Intelligence

SCIENCE

EXPLAIN

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 the feel of its skin 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 the feel of its skin 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 the feel of its skin 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 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 is a cephalopod?* (a sea creature that has tentacles attached to its head, like an octopus or squid)
- *What other animals might an octopus change its shape to look like?* (a mantis shrimp, sea snake, or flatfish)
- *What causes an octopus's skin to change color?* (opening or closing sacs in the skin)

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 _____

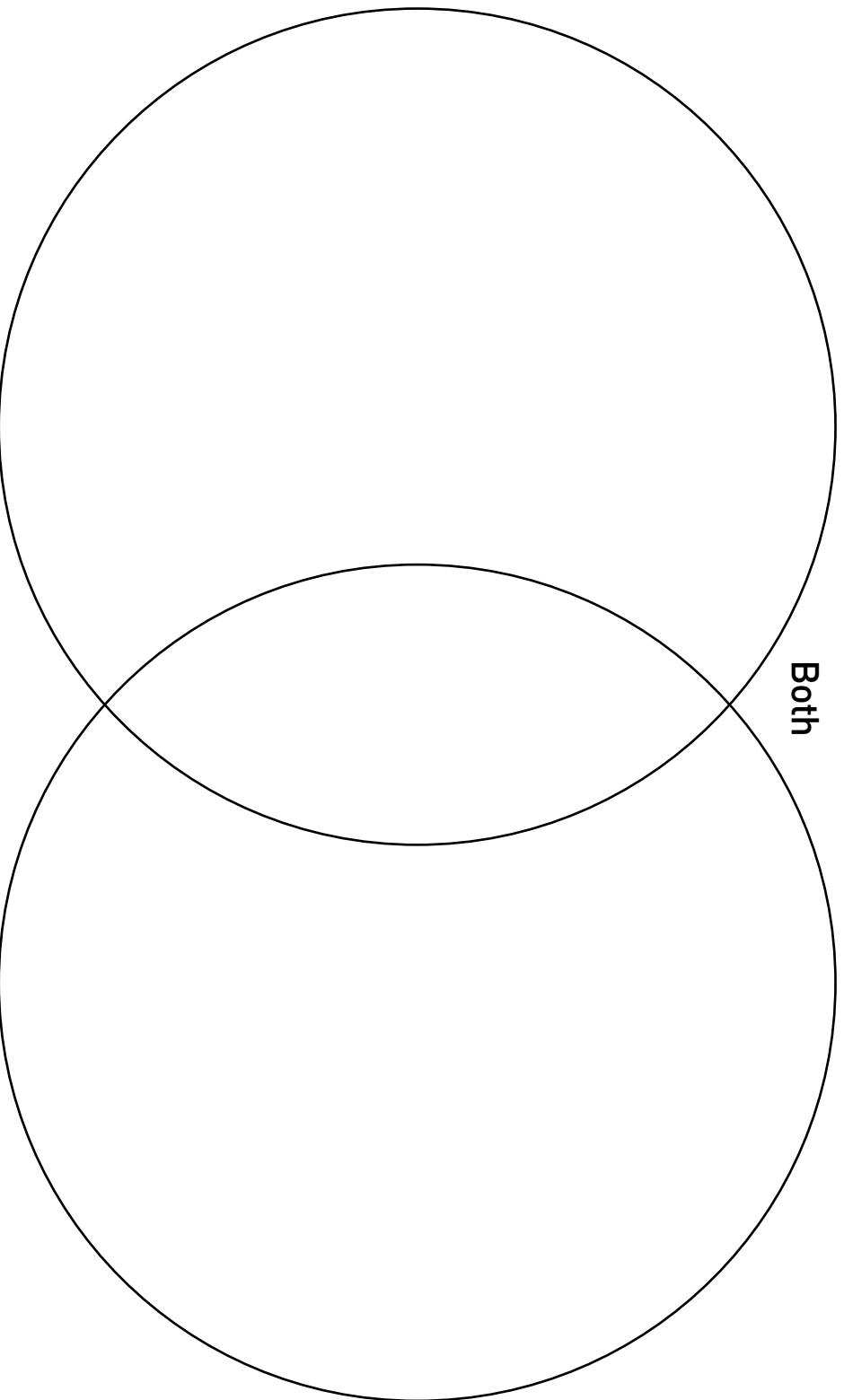
Date _____

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. How many arms does an octopus have?

A four

B six

C eight

2. Which words best describe an octopus's body?

A hard and stiff

B soft and squishy

C flat and shiny

3. What does an octopus have on its arms?

A fingers

B toes

C suckers

4. Which of these sentences is true?

A An octopus has blue blood.

B An octopus has five hearts.

C An octopus has a long backbone.

5. Describe one way an octopus changes color, shape, or the feel of its skin to disguise itself.

Going Bananas!

LANGUAGE ARTS 500L

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 and of specific paragraphs within a text.

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

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.

Inform students that what they just tried to identify was the main idea of the article. **Say:** *The main idea is the main topic, or what the article is about. Every article has a main idea. Every paragraph in the article has a main idea, too.* Inform students that important details in the text help readers identify the main idea of each paragraph. The main idea of each paragraph helps them identify the main idea of the text.

Display pages 10-11 of the projectable edition. Read aloud the headline. **Say:** *To figure out the main idea, I'll have to search for clues. The first clue is the headline, which reveals that the article is about bananas. But what exactly will it tell about bananas? To figure that out, we'll have to search for more clues.*

Read aloud the deck. **Say:** *According to the deck, people eat a whole lot of bananas and a disease is killing bananas. Maybe I'll learn about that problem as I read the article.*

Point out the comprehension strategy in the upper left corner of the screen. Read it aloud. **Say:** *I didn't notice this clue at first. But it's important because it helps me put all of the pieces together. The main idea of this article must be that people are trying to figure out how to stop a disease that is killing the world's bananas. To know for sure, I'll have to search for more clues as I read the article.*

Give each student a copy of the **Language Arts Assessment Master**. Have students record what they think is the main idea of the article. (Possible response: People are trying to figure out how to stop a disease that is killing the world's bananas.) Then have students read the article with a partner. As they read, encourage students to record important details from the article. After reading, instruct students to review their notes and rewrite the main idea of the article in their own words.

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.

- **Finding Connections** Explain to students that reading definitions tells people what words mean. But readers can get a more thorough understanding if they recognize how important words are connected. Point out that this is exactly what they did when they drew a picture illustrating the three vocabulary words. Instruct students to turn and share the pictures they drew on their **Vocabulary Assessment Masters** with a partner. Encourage them to discuss similarities and differences in their artwork to get an even deeper understanding of the vocabulary words.

- **Identify Main Ideas** Remind students that the article has a main idea. But each paragraph has a main idea, too. Explain that they can find the main idea of a paragraph the same way they found the main idea of the article. They must search for important clues. Select several paragraphs. Invite volunteers to read them aloud. After each one, challenge students to identify the main idea of each. Discuss how the main idea of each paragraph supports the main idea 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.

- *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 understand why a fungus is killing the Cavendish banana.
- Students will recognize how people are trying to solve the banana problem.

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, why a fungus is killing the Cavendish banana, and how people are trying to solve the banana problem.

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. Display page 11 of the projectable magazine. Review the introduction. **Ask:** *What does the introduction reveal about Cavendish bananas? (They're clones.) What does this mean? (Every single Cavendish banana is exactly alike.)* Remind students that clones are identical plants or animals grown from the cells of another plant or animal. **Ask:** *What does this tell you? (All Cavendish bananas come from the same 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.

Understanding the New Threat

Remind students that plants need sunlight and water to grow. They take in sunlight through their leaves. That's how they make their own food. Display page 14 of the projectable magazine. Review the section "A New Threat." **Ask:** *How does the fungus affect Cavendish banana plants? (It makes their leaves die.)* Guide students to understand that without leaves, the plant cannot get what it needs to live.

Recognizing Problems and Solutions

Display pages 12-13 of the projectable magazine. As a class, review the section "The Big Banana." **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 use information in the article 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. As a class, conduct research to identify four other varieties of edible bananas. Encourage each student to create a diagram like the one in the article that features the four types of bananas the class 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 didn't the 1950s fungus kill Cavendish bananas? (They were immune to the fungus.)*
- *Why are all Cavendish bananas alike? (They are clones.)*
- *How does the new fungus kill Cavendish bananas? (It kills their leaves so they 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 |
|------|------------|
| | |
| | |
| | |

Draw a picture that shows how the words are connected.



LANGUAGE ARTS ASSESSMENT: Going Bananas!

Use this organizer to identify the main idea of the article.

Write what you think the main idea is.

List important details from the article.

Rewrite the main idea in your own words.

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. Which banana was most popular in the 1950s?
 - Ⓐ the Cavendish
 - Ⓑ the Big Mike
 - Ⓒ Lady Fingers

- 2. Which plant part did a fungus kill in the 1950s?
 - Ⓐ the flowers
 - Ⓑ a roots
 - Ⓒ the leaves

- 3. Which plant part is a fungus killing now?
 - Ⓐ the flowers
 - Ⓑ the roots
 - Ⓒ the leaves

- 4. What are people trying to do to solve the problem?
 - Ⓐ Grow more Big Mikes.
 - Ⓑ Grow bananas in greenhouses.
 - Ⓒ Make a new banana.

5. Explain why all Cavendish bananas are alike.

Mission to Mars

LANGUAGE ARTS 530L

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 eight months to reach Mars?* (Mars is more than 140 times farther than the moon is from Earth.) *What would the crew need to survive a trip to Mars?* (air, water, and food) *Why couldn't they take all of the food, water, and air they needed?* (It would make the ship too heavy.) So how would they get these things they need to survive? (*The ship would recycle air and water. The crew would grow 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 would it be like inside a spacecraft traveling 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 bare and 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. How long would it take to get to Mars?
Ⓐ eight weeks
Ⓑ eight months
Ⓒ eight years

2. How could astronauts get more food on the trip to Mars?
Ⓐ buy it
Ⓑ recycle it
Ⓒ grow it

3. What happens to an astronaut's muscles in space?
Ⓐ They get stronger.
Ⓑ They get weaker.
Ⓒ They don't change.

4. What is the first thing people would need to do when they got to Mars?
Ⓐ Build a shelter.
Ⓑ Explore in a car.
Ⓒ Recycle their space suits.

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 creature that has tentacles attached to its head, like an octopus or squid

predators: animals that hunt and kill other animals to eat

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. B; 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 the feel of its skin.

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

Drawings should show how the vocabulary words are connected.

Assess Language Arts, page 15

Students should write a main idea. (People are trying to figure out how to stop a disease that is killing the world's bananas.) Details will vary. Students should rewrite the main idea in their own words.

Assess Content page, 16

Possible responses include:

(1950s) Problem: A fungus attacked the plants roots. Solutions: Growers tried to kill the fungus with chemicals. Outcome: The fungus spread until there were no more Big Mike Bananas left. The Cavendish became the new main banana.

(Now) Problem: A fungus is killing the leaves of Cavendish banana plants. Without leaves, the plants can't make food for themselves and they die. Solutions: People are trying to mix two kinds of bananas to make a new banana that is immune from the fungus. It could replace the Cavendish. Outcome: Student answers will vary.

Comprehension Check, page 17

1. B; 2. B; 3. C; 4. C; 5: All Cavendish bananas are alike because they're clones. They come from 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. C; 3. B; 4. A; 5: Answer will vary. Students might note differences identified on the "Earth vs. Mars" poster.