



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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The Four That Roar

LANGUAGE ARTS

LEXILE 730L

Objectives

- Students will assess their familiarity with and knowledge of vocabulary words.
- Students will identify the overall structure of ideas presented in the text.
- Students will explain concepts based on information in the text.

Resources

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

Summary

- The article “The Four That Roar” introduces students to four big cats—lion, leopard, jaguar, and tiger that share one unique trait: They roar.

BUILD VOCABULARY AND CONCEPTS

- adaptation
- apex predator
- conservationist
- poach
- reserve

As a class, discuss the difference between familiarity and knowledge. Guide students to recognize that the more familiar you are with something, the more knowledge you have. Challenge students to explain how this concept applies to words when they read.

Display the vocabulary words on a word wall or on the whiteboard. Give each student a copy of the **Vocabulary Assessment Master**. Instruct students to write each word on their papers. Review the categories under the header “Familiarity with the Word.” Tell students to make a checkmark to indicate how well they know each word.

Instruct students to write what they think each word means on their worksheets. Then display the Wordwise feature on page 9 of the projectable magazine. Have students write those definitions on their worksheets and compare them with the definitions they wrote.

READ

Give students a few minutes to scan the article's images in their student magazines. Then have them read the subheads. As a class, discuss how the images and subheads are related.

Guide students to recognize that the images show what the big cats look like. The subheads tell what they look like, how they act, and why that can lead to problems with humans. In essence, the subheads are a road map that will guide them as they read about the big cats they saw in the photos.

Explain to students that there are four basic types of text structure: chronology, comparison, cause/effect, and problem/solution. Review the basics of each. **Then say:** *When you're reading an article that gives multiple examples of the same thing, such as four different kinds of big cats, chances are good that the author will use more than one type of text structure in the text. For example, how do the big cats hunt for prey? Do they do it in the same way or are there big differences? If so, in the section that describes hunting behaviors, the writer likely used comparison to outline those differences. As you read the entire article and identify its central focus, you will find that the writer relied on one type of text structure to make the main point. That is the overall structure of the text.*

Give each student a copy of the **Language Arts Assessment Master**. Instruct students to circle what they think is the overall text structure used in this article. Then have students read the article on their own. As they read, instruct students to identify specific sections where the writer used each type of text structure. Challenge them to explain why they think the writer chose a specific type of text structure for each section.

The Four That Roar

LANGUAGE ARTS

TURN AND TALK

Have students turn and talk to discuss what they learned about the four big cats that roar. **Ask:** *What are the four cats that can roar?* (lion, leopard, jaguar, and tiger) *What is one way these four big cats are alike?* (Possible response: They are all carnivores.) *What is one way they are different?* (Possible response: They have different patterns on their fur.) Invite students to share what else they learned about the four big cats that roar.

- **Identify Text Structure** Review with students the different types of text structure. Encourage students to identify what they think is the overall text structure of this article. Challenge them to explain why. Then have students turn and talk to share their **Language Arts Assessment Masters** with a partner. Did they identify the same sections for each type of text structure? If so, did they explain the writer's choice in the same way? If students identified different sections, do both of their selections make sense? If not, encourage partners to read the section again.

- **Explain Concepts** After reading the article, **say:** *One way to see if you understand information is to try to tell someone else about the topic. If you can't explain the concept, you might need to read the article again.* Have students turn and talk to explain to a partner how why these four big cats can roar. Prompt discussion with questions such as: *Why do these four cats roar?* (They all have a missing bone in their voice boxes.) *What do they have instead?* (They have a band of stretchy tissue.) *Why do their roars sound different?* (The more the band stretches, the lower the sound that is made when the air passes across the vocal cords.) *What sound would the cats make if they didn't have the missing bone?* (They would purr.)

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 are "King of the Jungle" and "Ghosts of the Savanna" good nicknames for big cats that roar?*
- *What is a conservationist? How do conservationists help big cats?*
- *What surprised you about what you read?*

The Four That Roar

SCIENCE

Objectives

- Students will compare and contrast the four big cats that roar.
- Students will identify traits that help cats become successful hunters so they can survive.
- Students will recognize issues that lead to conflicts between big cats and humans.

Resources

- Content Assessment Master (page 8)
- "The Four That Roar" poster (Teacher's Edition)
- "Know Your Cats" poster (Teacher's Edition)
- Comprehension Check (page 9)
- "The Four That Roar" Interactive Whiteboard (optional)

Science Background

Big cats are the indisputable leaders in their domains. As apex predators, they reign at the top of the food chain. By limiting the number of plant eaters and preying on the sick, they keep their habitats healthy and their ecosystems in check.

Lions, tigers, jaguars, and leopards are four of the most fearsome predators. In addition to being outstanding hunters, they are the only four big cats that can roar. This is possible because they all have a missing a bone in their voice boxes.

Despite their status, these four big cats—like all other big cats around the world—are in danger of becoming extinct. One major problem they all face is the loss of habitat. As people clear land for new homes and businesses, big cats' habitats shrink. Their closer proximity to humans leads to inevitable conflicts between the two species.

Some people kill big cats. Farmers do this when the cats prey on their livestock. And poachers kill so they can sell the cats' body parts. But other people are trying to save big cats. They teach people how to live beside the predators. They set aside land for big cats to live on. They work to ensure that all big cats can survive.

ENGAGE

Tap Prior Knowledge

Poll the class to see how many students have a pet cat. Invite a few volunteers to describe their cats. What do the cats look like? How do they behave? Challenge the class to explain how domestic cats are similar to or different from big cats that live in the wild.

EXPLORE

Preview the Lesson

Display the cover of the projectable magazine. Invite volunteers to describe the big cat they see. Then have them describe the place where this big cat lives. **Ask:** *In what kind of environment does it look like this big cat lives?* (a jungle) Point out the cat's teeth and claws. **Ask:** *Based on these traits, how do you think this big cat gets its food?* (It hunts other animals.) Tell students that as they read the article they will learn why this behavior, which helps all big cats survive, can also cause conflicts between big cats and humans who live in the same environment.

Set a Purpose and Read

Have students read the article in order to compare and contrast the four big cats that roar, identify traits that help cats become successful hunters so they can survive, and recognize issues that lead to conflicts between big cats and humans.

The Four That Roar

SCIENCE

EXPLAIN

Compare and Contrast Big Cats

Display the **"The Four That Roar" poster**. Review the poster with the class. Encourage students to identify similarities between the big cats. (Possible responses: fur, sharp teeth, claws, etc.) Challenge students to identify differences. (Possible responses: color and pattern of fur, size, and hunting habits) Then display the map on pages 6-7 of the projectable magazine. **Say:** *This map shows the big cats' approximate ranges, or the areas where they live. As you can see, their ranges are in different places.* **Ask:** *But what does the article tell you all of these ranges have in common?* (They're shrinking.) Give each student a copy of the **Content Assessment Master**. Divide the class into small groups. Instruct groups to review the article and the poster. Challenge them to compare and contrast the four big cats that roar.

Identify Traits that Help Cats Survive

Display pages 4-5 of the projectable magazine. As a class, review the sections "Built to Hunt" and "Hunting Prey." Have students identify adaptations that help big cats catch prey. (Possible responses: long tails, claws, strong legs, etc.) Discuss how the cats use each adaptation. (Example: Strong legs and claws help leopards climb trees.) Then display the **"Know Your Cats" poster**. Review the poster with the class. Challenge students to identify adaptations that help these cats survive.

Recognizing Conflicts: Big Cats and People

Display the map on pages 6-7 of the projectable magazine. Remind the class that this map shows where big cats live. **Ask:** *Who else lives in these same places?* (people) Divide the class into small groups. Instruct groups to review pages 6-9 of the article in their student magazines. Then have students take out their **Content Assessment Masters**. Tell them to record problems that arise when big cats lose their habitats and solutions people have tried to solve these problems. Have students explain whether or not they think these solutions will be enough to save the big cats from extinction.

ELABORATE

Find Out More

Point out to the class that the map on pages 6-7 shows the current ranges of the four big cats that roar. It does not show what their ranges were in the past. Divide the class into groups. Instruct groups to conduct research to learn more about these shrinking habitats. How large did they used to be? What specifically caused them to shrink?

Extend Your Thinking About Big Cats

Remind students that in 2009 the National Geographic Society launched the Big Cats Initiative. Through conservation, education, and spreading the word about big cats, this program helps to ensure the survival of all big cats. As a class, brainstorm a list of ideas that would help the Big Cats Initiative succeed in its mission.

EVALUATE

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

- *What is a conservationist?* (a person who works to protect and manage Earth's natural resources and the wildlife that depends on those resources)
- *How can a reserve help protect big cats from poachers?* (The animals on a reserve are protected and they can roam freely. The people who protect them are on the lookout for poachers.)
- *How do photo safaris help save big cats?* (Tourists pay to go on photo safaris. The money they pay is used to help the cats. Locals work for the tour companies. They earn their living from keeping the animals safe.)

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: The Four That Roar

Record information from the article about each vocabulary word.

| Word | Familiarity with the Word | | | Knowledge of the Word | |
|------|----------------------------|-------------------------------------|------------------------|------------------------------|-----------------------------------|
| | I know the word very well. | I've seen or heard the word before. | I don't know the word. | What I think the word means: | How the article defines the word: |
| | | | | | |
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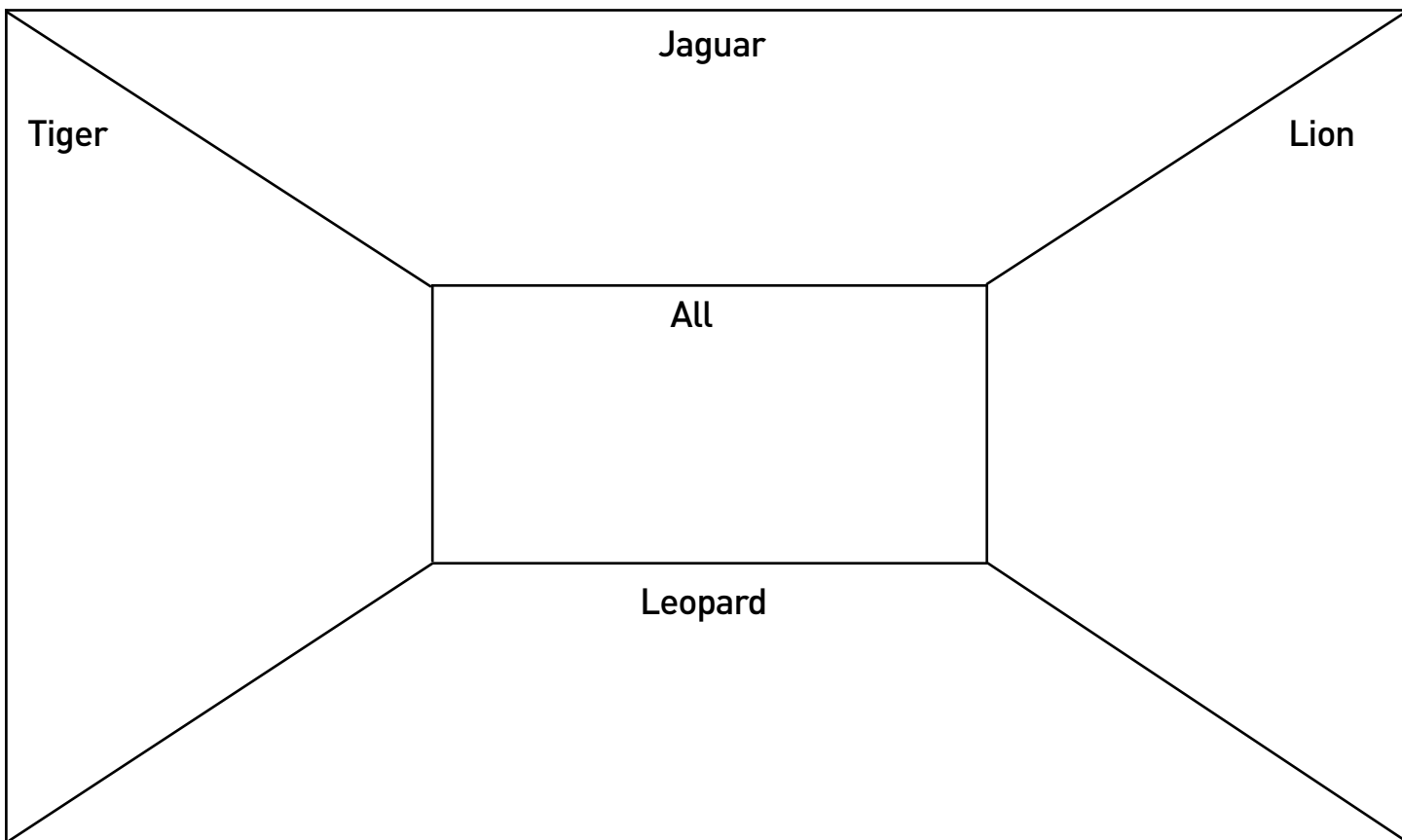
LANGUAGE ARTS ASSESSMENT: The Four That Roar

Circle what you think is the article's overall text structure. Identify sections that use each type of structure. Explain why the writer used certain types of structure in each section.

| Text Structure | Section | Explanation |
|------------------|---------|-------------|
| Chronology | | |
| Comparison | | |
| Cause/Effect | | |
| Problem/Solution | | |

CONTENT ASSESSMENT: The Four That Roar

Compare and contrast the four big cats that roar.



List problems that arise when big cats lose their habitats.

List solutions people have tried to help big cats survive.

Do you think these solutions will save big cats? Tell why or why not.

COMPREHENSION CHECK: The Four That Roar

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

- 1. Which adaptation helps big cats twist and turn during chases?
 - Ⓐ a long tail
 - Ⓑ a flexible spine
 - Ⓒ strong legs

- 2. How are the four big cats that roar the same?
 - Ⓐ They hunt zebras.
 - Ⓑ They climb trees.
 - Ⓒ They are apex predators.

- 3. How are conservationists and farmers working together to save big cats?
 - Ⓐ They are building pens for livestock.
 - Ⓑ They are creating reserves.
 - Ⓒ They are poaching big cats.

- 4. How are people helping jaguars survive in Central and South America?
 - Ⓐ They are building bomas for jaguars to live in.
 - Ⓑ They are connecting pieces of the jaguar habitat.
 - Ⓒ They are setting aside land for a jaguar reserve.

5. Describe two ways that photo safaris help save big cats.

Mountains in the Sea

LANGUAGE ARTS



Objectives

- Students will explore the meaning of vocabulary words in a variety of different ways.
- Students will use information in the article to explain the process that causes seamounts to create unique ecosystems in the ocean.

Resources

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

Summary

- The article “Mountains in the Sea” introduces students to seamounts, or mountains under the sea. Seamounts are one of the most common but least-known marine ecosystems in the world.

BUILD VOCABULARY AND CONCEPTS

- **biodiversity**
- **ecosystem**
- **seamount**

Read aloud each of the vocabulary words. As you do, poll the class to see how many students are familiar with each word. Then challenge volunteers to provide a scientific definition of each term.

Point out that this task was most likely easier with some of the words than others. **Say:** *As students, your vocabulary is constantly expanding. But many of the words you learn have multiple meanings. When reading about science, it's important to understand the scientific definition. And a great way to remember that more technical definition is to study the word in multiple ways.*

Give each student a copy of the **Vocabulary Assessment Master**. Instruct students to use this worksheet to explore the vocabulary words in four different ways: writing definitions, restating the definition in their own words, using the term in a sentence, and then drawing a picture to help them remember what the word means.

READ

Inform students that the purpose of this article is to help them understand what seamounts are and how they affect the ocean around them.

Display pages 2-3 of the projectable magazine. Invite a volunteer to read aloud the headline and text. **Ask:** *What is a seamount? (a mountain under the sea) How do seamounts affect the ocean? (They change ocean currents.) And what does this cause? (It creates unique and thriving ecosystems in the ocean.)*

Point out to the class that it's easy to summarize this information in a few sentences. But to really understand how or why it happens, they must look for additional clues in the text. **Say:** *In science, there is always a reason why things happen. Certain results, such as the creation of a new ecosystem, can only occur if specific things happen. And most often, those things must occur in a certain order. If that process changes, the results will change, too.*

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 clues that explain how a seamount's structure changes ocean currents and why this results in the creation of new ocean ecosystems. Challenge students to create a diagram that illustrates how and why this process occurs.

Mountains in the Sea

LANGUAGE ARTS

TURN AND TALK

Have students turn and talk to discuss what they learned about seamounts. **Ask:** *What is a seamount?* (an underwater mountain formed by volcanic activity) *Why don't people know much about them?* (They are located far beneath the ocean's surface.) *What happens to ocean water at the summit of a seamount?* (It gets trapped in a spin.) *What happens then?* (Plants and animals that get trapped in the spinning water become food for ocean predators.)

- **Exploring Meanings** Inform students that it's essential for readers to understand the technical definition of words when reading about science. Without that knowledge, it's very difficult to understand the text. **Say:** *Once you do understand what scientific terms mean, not only can you follow along with the text but you can use the words correctly in new sentences of your own.* Challenge students to make accurate statements using each of the vocabulary words. Encourage them to use their **Vocabulary Assessment Masters** as resources. But remind them to be original. Students shouldn't restate sentences from the article. They should create new sentences of their own.

- **Explaining Processes** After reading the article, remind students that explaining processes is a strategy that people use to better understand what they're reading. Point out all the information they need can be found in order as they read the text. And once they have collected all of the clues, they will understand how and why things happen. Have students share their **Language Arts Assessment Masters** in small groups. Instruct students to compare the information they recorded. Then have them analyze how the diagrams they drew help them understand this process.

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 can people learn when they explore seamounts?*
- *Why is it important to protect seamount ecosystems?*
- *What surprised you about what you read?*

Mountains in the Sea

SCIENCE

Objectives

- Students will understand the life cycle of a seamount.
- Students will recognize that seamounts often appear in groups near "hotspots."
- Students will recognize the diversity among plants and animals that live in different zones of a seamount ecosystem.

Resources

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

Science Background

Seamounts are underwater mountains that rise at least 1,000 meters above the ocean floor. They are formed by volcanic activity and are often the remains of old volcanoes.

Although each seamount is an individual structure, seamounts often form in groups or long chains. This is because seamounts are found near "hotspots" in the oceanic crust. Melted rock called "magma" bubbles up through a "hotspot." When a moving tectonic plate passes over the "hotspot," a chain of volcanoes rises in its wake.

Scientists estimate that there are more than 100,000 seamounts in the world's oceans. Yet less than one-tenth of a percent of those seamounts have ever been explored. But as more explorations take place, scientists have quickly learned that seamounts are more than underwater obstacles for submarines to avoid. They are also rich, diverse habitats that cover more area than any land-based habitat on Earth.

Seamounts have tall, steep sides. This causes ocean water to flow upward, pushing nutrients toward the surface. Some organisms attach to a seamount's side where they settle and grow. Others become trapped in the spinning water at the seamount's summit. While they can feast on the nutrients that also become trapped here, they are easy prey for larger ocean predators.

ENGAGE

Tap Prior Knowledge

Instruct students to think about the tallest mountain they've ever seen—either in real life or in a photograph. Now tell them to imagine that this mountain is located in the ocean. It sits on the ocean floor, well below the water's surface. Brainstorm ideas about what students might discover if they were able to explore this mountain.

EXPLORE

Preview the Lesson

Display pages 10-11 of the projectable magazine. Have students examine the diagram. **Ask:** *What part of this diagram can tell you the height of this seamount? (the meter marks) Why is the top meter mark located above the top of the seamount? (That mark shows the water's surface. The seamount is located 200 meters below the water's surface.) What else does this diagram tell you about seamounts? (It identifies zones and tells what lives in each one. It shows that the amount of light decreases the deeper you go in the water.)* Tell students that they'll learn more about seamounts as they read the article.

Set a Purpose and Read

Have students read the article to understand the life cycle of a seamount, recognize that seamounts often appear in groups near "hotspots," and to recognize the diversity among plants and animals that live in different zones of a seamount ecosystem.

Mountains in the Sea

SCIENCE

EXPLAIN

Understanding the Seamount Life Cycle

Display page 14 of the projectable magazine. Zoom in on the section "Seamount Life Cycle" and highlight the subhead. **Say:** *Seamounts are not living things. They are underwater mountains.* **Ask:** *How can a seamount have a life cycle?* (They have a beginning, middle, and an end.) Give each student a copy of the **Content Assessment Master**. Have students review the section and then complete the top part of their worksheets. Instruct students to identify each stage in the life cycle of a seamount, draw a picture, and explain what happens during that stage. Tell students not to copy information directly from the article, but to explain the process in their own words.

Recognizing Where Seamounts Appear

Display pages 12-13 of the projectable magazine. Zoom in on the map. Inform students that the gray ridges in the oceans show the edges of tectonic plates. Point out the red dot. **Say:** *This dot is not on one of those gray ridges. That's because seamounts like this one are often located on "hotspots" in the oceanic crust. "Hotspots" aren't on plate borders. They form where melted rock called "magma" bubbles up through the crust. This creates volcanoes.* Explain that seamounts are often the remains of old volcanoes. Like mountains, they can form long chains. But these chains are on the ocean floor. Instruct students to review the section "Volcanic Peaks" on page 12 of their student magazines. Then challenge them to answer the question at the bottom of their

Content Assessment Masters.

Surviving in Seamount Ecosystems

Display pages 10-11 of the projectable magazine. Point out the class that the meter marks in the diagram correspond with the layers of mountain life identified in the sidebar. Review the information as a class. Then have students examine the article's photos. Ask students which zones they think are shown in each of these photos. Challenge them to explain why.

ELABORATE

Find Out More

Display pages 14-15 of the projectable magazine. Inform students that the three animals shown here live in seamount ecosystems. Divide the class into small groups. Instruct groups to conduct research to find photos of more seamount organisms. Challenge them to find photos of organisms that live in each layer of a seamount ecosystem.

Extend Your Thinking About Seamounts

As a class, review the final section of the article, "Seamount Security." Discuss how people's actions are damaging seamount ecosystems. Brainstorm ideas about how people can work together to help protect them.

EVALUATE

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

- *What is a seamount?* (an underwater mountain formed by volcanic activity)
- *How is the sunlight zone in a seamount ecosystem different from the abyss?* (There is sunlight in the sunlight zone. It is full of plants and animals. There is no sun in the abyss. It is cold, pitch black, and has high pressure. There are no plants, but there are some animals.)
- *How does a seamount's height change ocean currents?* (Its slopes force water up the sides. Water moves faster around seamounts than in the open ocean.)

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

VOCABULARY ASSESSMENT: Mountains in the Sea

Use this organizer to examine each vocabulary word.

| | |
|--------------------------|-----------------------------|
| Write the definition. | Restate in your own words. |
| What is the word? | |
| Draw a picture. | Use the term in a sentence. |

| | |
|--------------------------|-----------------------------|
| Write the definition. | Restate in your own words. |
| What is the word? | |
| Draw a picture. | Use the term in a sentence. |

| | |
|--------------------------|-----------------------------|
| Write the definition. | Restate in your own words. |
| What is the word? | |
| Draw a picture. | Use the term in a sentence. |

LANGUAGE ARTS ASSESSMENT: Mountains in the Sea

Explain how seamounts change ocean currents. Explain why this creates new ocean ecosystems. Draw a diagram that illustrates this process.

Explain How

Explain Why

| | |
|--|--|
| | |
|--|--|

Draw a Diagram

| |
|--|
| |
|--|

COMPREHENSION CHECK: Mountains in the Sea

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

- 1. Where are seamounts located?
 - Ⓐ in deep oceans
 - Ⓑ in shallow oceans
 - Ⓒ near the beach

- 2. Where on a seamount does ocean water get trapped in a spin?
 - Ⓐ at the top
 - Ⓑ in the middle
 - Ⓒ at the bottom

- 3. Which seamount zone has the most biodiversity?
 - Ⓐ midnight zone
 - Ⓑ twilight zone
 - Ⓒ sunlight zone

- 4. What causes seamounts to form?
 - Ⓐ mountains
 - Ⓑ volcanoes
 - Ⓒ ocean currents

5. Describe the four stages of a seamount life cycle.

Objectives

- Students will record, define, and sketch vocabulary words and draw a picture to show how the words are related.
- Students will recognize characteristics of writing in the first-person point of view.
- Students will write a first-person narrative about the article.

Resources

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

Summary

- In the article "Signs and Symbols," National Geographic Emerging Explorer Genevieve von Petzinger reveals important findings from her extensive research on paintings and engravings in ice age caves in Europe.

BUILD VOCABULARY AND CONCEPTS

- engraving
- ice age
- symbol

Display the vocabulary words on a word wall or on the whiteboard. Say the words aloud and invite students to share what they know about each.

Give each student a copy of the **Vocabulary Assessment Master**. Instruct students to write each word and its definition on their papers. Then have students draw a picture to remind themselves of what each word means.

When students are finished drawing their interpretations of individual words, discuss with the class how the words could be related. Then challenge students to sketch a larger picture showing a potential connection between the three words. Instruct students to label each item in their drawings.

READ

Let students know that in this article they meet National Geographic Emerging Explorer Genevieve von Petzinger and learn about important findings from her extensive research on paintings and engravings in ice age caves in Europe.

Inform students that this article is written in first person. As they read, they will experience the trip through von Petzinger's eyes as she squeezes through tight, muddy caves to explore ancient symbols drawn on their walls.

Discuss what the first-person point of view is and how it impacts both the writing and content of the article. **Say:** *First person means that the article is written from the writer's point of view. This type of writing is easy to spot. Sentences contain the words I and we. Content is descriptive, but the text is written so readers experience the event just as the writer did when it occurred.*

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 notice where the symbols are located and what von Petzinger must go through to find them. Remind the class that nobody knows what these symbols mean.

Instruct students to select and draw one or more symbols from the diagram on page 23 of the article. Then have them imagine that they lived during the last ice age. Tell students to think about something that could have happened and caused them to draw those symbols on a cave wall. Then have them write a short story that tells what happened and reveals what the symbols mean. Remind students to write their narratives from the first-person perspective.

LANGUAGE ARTS

TURN AND TALK

Have students turn and talk to discuss what they learned about Genevieve von Petzinger and her quest to understand the ancient signs and symbols on cave walls. **Ask:** *When were the signs and symbols von Petzinger studies created? (during the last ice age; some 40,000 years ago) Why is it so hard to find some of the signs and symbols? (They are written on walls deep inside tight, muddy caves.) What did von Petzinger discover after exploring more than 350 different cave sites? (The same 32 symbols appear at each site.)* Encourage students to share other facts they learned as they read the article.

- **Recognizing First Person** Remind students that first-person is a type of writing in which the text is presented from the writer's point of view. Select a section of the article. Have students point out each use of the words *I* and *we*. Replace the pronouns with *he/she/they* or *him/her/them* to rewrite that section from a different perspective. Examine the results. Discuss why first-person was a good choice for the writer to use as she wrote this article.
- **Writing a First-Person Narrative** Point out to students that when people speak, they often tell stories from the first-person point of view. But when they write, particularly in published material like magazine articles, it's more common to use the second- (*he/she/they*) or third-person (*him/her/them*) perspective. **Say:** *That's because most of the time people are writing about other people's experiences. Because of that, second- or third-person makes sense. If anyone other than Genevieve Von Petzinger had written this article, it would have been written that way, too.* Inform students that one benefit of writing from the first-person point of view is that it brings readers into the story. **Say:** *You aren't watching someone explore a narrow cave. You're in the cave with them.* Have students take out their **Language Arts Assessment Masters**. Instruct students to share their narratives in small groups. Tell them to examine how writing in first-person impacted how the writer wrote the story and how the listeners felt when they heard it.

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 is an ice age?*
- *Von Petzinger says ice age signs and symbols on cave walls are not a form of written language. Based on what you learned from the article, do you agree? Why or why not?*
- *What surprised you about what you read?*

Signs and Symbols

SOCIAL STUDIES

Objectives

- Students will understand how ice age periods change the land.
- Students will understand how the author observes and records information about the past.

Resources

- Content Assessment Master (page 24)
- Comprehension Check (page 25)

Social Studies Background

As a young child, National Geographic Emerging Explorer Genevieve von Petzinger loved to dig things up. And like many children, she became obsessed with dinosaurs. It wasn't until her teen years that she realized her true passion. She wanted to learn about the people who lived thousands of years ago.

Now a paleoanthropologist, von Petzinger studies our human ancestors using fossils and other remains. Her primary focus is studying the geometric signs and symbols that are painted and engraved on cave walls.

Von Petzinger says she became intrigued with the signs and symbols because nobody else in her field was studying them. Everyone else was focused on the drawings of animals and people.

Over the past few years, von Petzinger has explored more than 350 ice age sites in Europe. Her work has taken her deep into caves, often crawling through tight passages. She has recorded her findings at each site and built a database to interpret the information. It revealed a startling fact: The signs and symbols were created over a 30,000-year time period, but there were only 32 symbols in all.

Now, the challenge is to interpret what the signs and symbols mean. Von Petzinger admits that may be an impossible task. But with the help of modern technology the study of things like constellations, lunar cycles, and ancient landscape features, she hopes to find out.

ENGAGE

Tap Prior Knowledge

Have each student take out a piece of paper. Then ask them to draw symbols that represent three things: a question; addition; and money. Compare students' responses. Are they all the same? {?, +, \$} Guide the class to understand that this likely happened because these are the symbols used to represent those concepts in our culture. As a class, discuss how people could learn to interpret symbols from a culture that ended 10,000 years ago.

EXPLORE

Preview the Lesson

Display pages 16-17 of the projectable magazine. Instruct students to examine the image. Poll the class to see how many students think the circled symbols have a meaning? Brainstorm ideas about what those meanings could be.

Set a Purpose and Read

Have students read the article in order to understand how ice age periods change the land, and how the author observes and records information about the past.

EXPLAIN

Understanding Ice Ages

Display page 19 of the projectable magazine. Zoom in on the sidebar about ice ages. Invite a volunteer to read the information aloud. **Ask:** *What happens during an ice age?* (Glaciers cover large parts of the world.) *How long can an ice age last?* (millions of years) *What happens when an ice age ends?* (The glaciers melt.) Remind students that glaciers are huge masses of ice that flow like very slow rivers across the land. As they move, they reshape the land beneath them. Brainstorm ideas about how the last ice age and the warm period that followed could have changed Earth's surface.

EXPLAIN

(continued)

Understanding How People Study the Past

Display page 18 of the projectable magazine. Zoom in on the blurb at the bottom of the page. Invite a volunteer to read it aloud. **Say:** *When we think about studying the past, fossils are one of the first things that come to mind. We can learn a lot from studying the remains of plants and animals that lived long ago. But fossils aren't the only things that can teach us about the past. Artifacts can do that, too. Artifacts are objects created by humans at different times in the past.* **Ask:** *What types of artifacts does Genevieve von Petzinger study? (signs and symbols) Where does she find them? (in caves)* Assign each student a partner and give each student a copy of the **Content Assessment Master**. Explain to the class that this worksheet contains four statements related to the article. Challenge students to find information from the article to explain why each sentence is true. Instruct them to also explain how each detail is connected to von Petzinger's work.

ELABORATE

Find Out More

Remind students that the last ice age ended 10,000 years ago. According to the article, people who lived then left behind artifacts including tools, clothing, shelters, and art that was painted and engraved on cave walls. Divide the class into small groups. Instruct groups to conduct research to learn more about these artifacts. Have groups analyze the artifacts and share what the artifacts tell them about ice age civilizations.

Extend Your Thinking About Signs and Symbols

Remind students that nobody knows what the ancient signs and symbols on cave walls mean. The writer thinks some might represent landforms. Divide the class into small groups. Instruct students to study the signs and symbols in the diagram on page 23 of their student magazines. Challenge groups to write a plausible meaning for each sign, based on life as it existed during the last ice age.

EVALUATE

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

- *What is a symbol?* (something that stands for or represents something else)
- *What does "engraving" mean?* (the process of cutting or carving a design on a hard surface.)
- *How did ice age people create handprints on cave walls?* (They rubbed iron oxide over a hand pressed to the wall.)

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

Name _____

Date _____

VOCABULARY ASSESSMENT : Signs and Symbols

Write each word and its definition. Draw a small picture to show what each word means. Draw a larger picture to show how the words could be related. Label each word in your sketch.

| Word | Definition | Picture | Larger Picture | |
|------|------------|---------|----------------|--|
| | | | | |
| | | | | |

LANGUAGE ARTS ASSESSMENT: Signs and Symbols

Pick one or more symbols from page 23 of the article. Draw a picture of each.

Imagine that you lived during the last ice age. Write about something that happened and caused you to draw the symbols on a cave wall. Tell what the symbols mean.

Horizontal lines for writing a response.

CONTENT ASSESSMENT: Signs and Symbols

Use information from the article to explain why each sentence is true. Include details about how each fact connects to von Petzinger's work.

| Sentence | Explanation |
|---|-------------|
| <p>During the last ice age, people painted and engraved on cave walls.</p> | |
| <p>Observing ice age artwork is physically demanding work.</p> | |
| <p>There are patterns in ice age signs and symbols.</p> | |
| <p>Collecting and analyzing more data may help us understand the signs and symbols.</p> | |

COMPREHENSION CHECK: Signs and Symbols

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

1. Where does Genevieve von Petzinger go to study our human ancestors?

- Ⓐ museums
- Ⓑ glaciers
- Ⓒ caves

2. What happens during an ice age?

- Ⓐ Freezing rain constantly falls from the sky.
- Ⓑ Glaciers cover large parts of the world.
- Ⓒ The North and South poles switch places.

3. Which of these ice age artifacts is most common in a cave?

- Ⓐ images of people
- Ⓑ images of animals
- Ⓒ symbols

4. Which of these statements is true?

- Ⓐ Ice age signs and symbols are meaningless.
- Ⓑ There are hundreds of different ice age signs and symbols.
- Ⓒ Ice age signs and symbols are at least 10,000 years old.

5. What did von Petzinger's database reveal about ice age signs and symbols?

The Four That Roar

Assess Vocabulary, page 6

Students should record the vocabulary words from the Wordwise feature on page 9, make checkmarks to show how familiar they are with each word, and write definitions in their own words. Then they should record the definitions from the article.

adaptation: a behavior or body art that helps an animal survive

apex predator: the most powerful predator in an ecosystem

conservationist: a person who works to protect and manage Earth's natural resources and the wildlife that depends on those resources

poach: to illegally hunt an animal, usually to sell its meat, skin, or other body parts

reserve: a tract of public land set apart for the protection of plants and animals

Assess Language Arts, page 7

Students should circle the option they think is the overall text structure of the article. Sections identified for each type of text structure may vary. All choices should be supported with valid reasons.

Assess Content, page 8

Students may identify differences in fur, hunting behaviors, or habitats. Similarities include: all four roar, are carnivores, and apex predators. All four also have shrinking habitats, problems with humans, and potentially face extinction.

Potential problems: fewer wild animals to eat; prey on livestock; farmers kill them; and poachers

Potential solutions: paying farmers not to kill the big cats; building pens for livestock; setting aside land for reserves; connecting habitats; and photo safaris

Student responses to the final question will vary.

Comprehension Check, page 9

1. B; 2. C; 3. A; 4. B; 5. Possible response: The money tourists pay to see big cats goes toward conservation efforts. Locals hired to work at tour companies realize the big cats are valuable and worth protecting.

Mountains in the Sea

Assess Vocabulary, page 14

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

biodiversity: the many different kinds of plants and animals on Earth or in a habitat or ecosystem

ecosystem: the plants, animals, and non-living things that make up an environment and affect each other

seamount: an underwater mountain formed by volcanic activity

Students should restate each definition in their own words. Sentences and drawings will vary but should accurately reflect the meaning of each word.

Assess Language Arts, page 15

Explain how: A seamount's slopes force water up its sides. Water moves faster around seamounts than in the open ocean.

Explain why: As the ocean water rises, it carries nutrients to the surface. Organisms living at the summit eat the nutrients. They become trapped in spinning water and larger predators eat them.

Diagrams should resemble the diagram on pages 10-11 of the student magazine.

Assess Content page, 16

Stage 1: Eruption; A volcano erupts through the seafloor.

Stage 2: Build-up: The volcano spits out magma.

Stage 3: Erosion: If a seamount is above the water line, wind and rain grind it down over time. Below the surface, landslides and ocean currents wear it away, too.

Stage 4: Death: The ground beneath the seamount cools. The seamount becomes denser and slowly begins to sink.

Students' drawings should represent what is happening during each stage.

Students may respond that they know seamounts often form in groups because many seamounts are part of long underwater mountain chains.

Comprehension Check, page 17

1. A; 2. A; 3. C; 4. B; 5. Students should describe a seamount's eruption, build-up, erosion, and death.

ANSWER KEY

(continued)

Signs and Symbols

Assess Vocabulary, page 22

Students should record the words and definitions from the Wordwise feature on page 22.

engraving: the process of cutting or carving a design on a hard surface

ice age: any of several cold periods during which glaciers covered much of Earth

symbol: something that stands for or represents something else

Sketches should accurately reflect the meaning of each word and how the terms are connected. Students should label all three terms in the larger drawing. Evaluate each response for accuracy.

Assess Language Arts, page 23

Students should copy one or more signs or symbols from the diagram on page 23 of the article. Stories should revolve around something that could have happened during the last ice age. Students should tell what happened, why they drew the symbols on the cave wall, and what each symbol means.

Assess Content, page 24

Possible responses include:

Explanation 1: We can see their artwork and symbols because it is still on cave walls today. Von Petzinger observes and records the signs and symbols they left behind.

Explanation 2: Ice age people drew signs and symbols deep inside caves. Von Petzinger must crawl through tight, muddy passages to see it.

Explanation 3: The same signs and symbols appear across sites across Europe. . After analyzing them, Von Petzinger discovered that there are only 32 different symbols.

Explanation 4: Right now, nobody knows what the signs and symbols mean. Without anyone to tell us what they mean, von Petzinger must keep analyzing data to try to discover their purpose.

Comprehension Check, page 25

1. C; 2. B; 3. C; 4. C; 5: Her database revealed that there are only 32 different symbols and that the symbols and they are repeated across sites throughout Europe and they cover a span of 30,000 years.