

In This Guide

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

Explorer Magazine

EXPLORER classroom magazines are written for each grade, 2-5. Through great storytelling and stunning photographs, the magazines develop literacy skills and teach standards-based content aligned with the Common Core State Standards (CCSS), Next Generation Science Standards (NGSS), or National Council for the Social Studies (NCSS). The activity on the magazine's back cover is tailored to the NG Learning Framework. (see page 2)

EXPLORER magazines offer engaging reading opportunities for students with different ability levels in the same class. All articles have been measured using the Lexile® Framework for Reading. Articles in EXPLORER PIONEER will be within the 250-550L range.

For additional resources to extend your students' learning, visit EXPLORER's website, natgeo.org/explorermag-resources.



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INTRODUCTION

BACKGROUND

Since 1888, the National Geographic Society has funded scientists and explorers and shared their findings with the world. To support educators who use our resources, we have created a Learning Framework, which lays out what we believe students should learn from their experiences with the Society.

PURPOSE

The Learning Framework was designed to convey the Society's core beliefs and values. It is built around a set of attitudes, skills, and knowledge that embody the explorer mindset.

To determine the learning outcomes within the Learning Framework, we dug deep into national standards in key subject areas. We also sought advice from subject matter and child development experts, along with the combined expertise of NG instructional designers, researchers, and content developers. To learn more, go to: <https://www.nationalgeographic.org/education/learningframework/>.

IMPLEMENTATION

Each article in this magazine has a knowledge-based link to the Learning Framework. Students will use the skills and attitudes as they do the activity on the back cover. The activity relates to the article "Clever Levers."

MINDSET OF AN EXPLORER

KEY FOCUS AREAS



Attitudes

National Geographic kids are:

CURIIOUS about how the world works, seeking out new and challenging experiences throughout their lives.

RESPONSIBLE, with concern for the welfare of other people, cultural resources, and the natural world. NG kids are respectful, considering multiple perspectives, and honoring others regardless of differences.

EMPOWERED to make a difference. NG kids act on curiosity, respect, and responsibility. They are adventurous and persist in the face of challenges.



Skills

National Geographic kids can:

OBSERVE and document the world around them and make sense of those observations.

COMMUNICATE experiences and ideas effectively through language and media. They are storytellers!

COLLABORATE with others to achieve goals.

SOLVE PROBLEMS by generating, evaluating, and implementing solutions after identifying alternatives, weighing trade-offs, and making well-reasoned decisions.



Knowledge

National Geographic kids understand:

THE HUMAN JOURNEY is all about where we have been, where we live now (and why), and where we are going.

OUR CHANGING PLANET encompasses all that coexists on our planet—interconnected through systems that generate and nurture each other.

WILDLIFE AND WILD PLACES inhabit our planet—from the butterflies in our backyards to the lions in Africa.

Standard Supported

- Identify the main topic of a multiparagraph text as well as the focus of specific paragraphs within the text. (CCSS.RI.2.2)

Resources

- Vocabulary Assessment Master (page 7)
- Language Arts Assessment Master (page 8)

Summary

- The article "Pollination Nation" introduces students to unusual pollinators that are keys to keeping some flowering plants alive.

BUILD VOCABULARY AND CONCEPTS

- **nectar**
- **pollen**
- **pollinate**
- **pollinator**

Display the vocabulary words on page 9 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**. Have students record each word and its definition. As a class, brainstorm ideas about how the words are related. For example, flowers produce both nectar and pollen. Have students write four sentences telling how the words are connected, using two or more vocabulary words in each sentence.

After reading the article, divide the class into small groups. Instruct students to share the connections they predicted and reevaluate their ideas. If necessary, have them revise their responses based on what they've learned.

READ

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

Explain to students that what they just attempted to identify was the main idea of the article. Tell the class that the main idea is the main topic. Everything in the article is connected to the main idea. Point out that paragraphs have a main idea, too. Everything in a paragraph is connected to its main idea.

Display pages 2-3 of the projectable magazine. Model how to identify the main idea of the article. **Say:** *When I look at these pages, the first thing I notice is the photo. It's hard not to notice that bee. But then I see the headline, "Pollination Nation." I wonder what it means?*

Explain to students that the headline and photo are often great clues that can help readers figure out what an article is about. **Say:** *But sometimes clues that aren't so obvious are even more helpful, particularly if you aren't sure what a word in the headline—such as pollination—means. Zoom in on the deck and read it aloud. Say: Now I know what this article is about. It is going to tell how bees and other animals help plants.*

Have students read the article in small groups. As they read, encourage student to search for details that support the main idea of the article.

Pollination Nation

LANGUAGE ARTS

TURN AND TALK

Have students turn and talk to discuss what they learned about pollination. **Ask:** *What happens when plants are pollinated?* (Pollen from one flower is moved to another flower.) *What do you call an animal that pollinates flowers?* (a pollinator) *What can plants do after they are pollinated?* (make seeds) Invite students to share what else they learned about pollination.

- **Identify Main Ideas** Remind students that the article has a main idea. (Bees and other animals help plants.) But paragraphs have main ideas, 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. Give each student a copy of the **Language Arts Assessment Master**. Instruct students to write the main idea of the article in the middle circle. Then have them select four paragraphs in the article. Challenge them to write the main idea of each. Encourage students to turn and talk to analyze and compare results. Challenge them to recognize how the main idea of each paragraph ultimately supports the main idea of the text.

WRITE AND ASSESS

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

- *Why is pollen important to flowers?*
- *Why is the subhead "Beyond Bees" a good way to describe the main idea of this article?*
- *What surprised you about what you read?*

Standard Supported

- Plants depend on animals for pollination or to move their seeds around. (NGSS.2-LS2-2)

Resources

- Content Assessment Master (page 9)
- Comprehension Check (page 10)

Science Background

The goal of every living organism is to reproduce. One way plants reproduce is to make seeds. And in order for plants to make seeds, they must undergo pollination.

During pollination, pollen grains are transferred from the anther, which is the male part of a flower, to the stigma, which is the female part. Sometimes, pollen is moved from the anther to the stigma on the same plant. Other times, it must be moved from one plant to another. Either way, if pollination occurs between plants of the same species, new seeds are produced.

Since plants can't move by themselves, they need help to move pollen. Some plants rely on wind or water. But most—up to 90%— get help from animals. These animals that transfer pollen from one flower to another are called "pollinators."

Pollinators don't visit flowers with the intent of helping the plants make seeds. They go there for the food. Lured by brightly colored petals or sweet smells, animals go to flowers so they can feast on the plant's fruit, nectar, or pollen. As they eat, pollen sticks to their bodies. As they move, they take the pollen with them.

More than 200,000 different animals pollinate plants. About 1,500 of these pollinators are birds, mammals, or reptiles. The rest are insects. Working together, they ensure that the next generation of plants is able to grow.

ENGAGE

Tap Prior Knowledge

Give each student a piece of plain white paper. Instruct students to draw and color a picture that shows what they think of when they hear the word "pollination." Compare and contrast the results. How many students' drawings showed a flower? How many included a bee visiting that flower? Did any drawings show different animals with the flower? Encourage students to share what they know about pollination.

EXPLORE

Preview the Lesson

Display the cover of the projectable magazine. Invite volunteers to identify the animal they see. (a bee) Then point out the yellow blob on the bee's leg. **Ask:** *What is this yellow stuff?* (pollen) *Where did it come from?* (the flower) *How did it get on the bee?* (It stuck to the bee's leg when the bee visited the flower.) Brainstorm ideas about how this can help the flower. Tell students that as they read the article they will learn more about how bees and other animals help plants when they pollinate flowers.

Set a Purpose and Read

Have students read the article in order to understand what pollination is and identify different animals that help plants when they pollinate their flowers.

EXPLAIN

Understanding Pollination

Display the Wordwise feature on page 9 of the projectable magazine. Highlight the vocabulary words *pollen*, *pollinate*, and *pollinator*. Challenge students to explain how these three words are connected. (Pollinators move pollen from one flower to another when they pollinate flowers.) Guide students to recognize that this process is called "pollination." Use the diagram "Pollination Process" on page 5 of the projectable magazine to help students understand this point. **Then ask:** *How does it help plants when animals pollinate their flowers?* (Plants can't move. Many depend on animals to move their pollen around.)

Recognizing Different Pollinators

Instruct students to examine the article's photos in their student magazines. **Ask:** *How are all of these photos the same?* (They each show an animal visiting a flower.) *How are they different?* (There is a different animal in every photo.) **Say:** *People often think of bees when they think of pollinators. But lots of different types of animals pollinate flowers. When they do, both the plant and the animal benefit. The animal gets food and the plant can make seeds.* Give each student a copy of the **Content Assessment Master**. Instruct students to select one animal from the article. Have them draw a picture of the animal pollinating a flower and describe what is happening. Then challenge them to explain why plants need animals like these to survive. Compare and contrast the results.

ELABORATE

Find Out More

Point out to students that the article identifies several animals that pollinate flowers. But lots of other animals do this, too. Divide the class into small groups. Have groups conduct research to identify another animal that pollinates flowers. Encourage them to find a photo. Challenge them to describe in detail how the animal does this. Invite groups to present their findings to the class.

Extend Your Thinking About Pollination

Point out to the class that some animals are built to collect pollen from certain types of flowers. For example, bats have special nose shapes and tongue lengths that help them drink nectar from different shaped flowers. But some flowers are built to attract certain pollinators, too. As a class, discuss how shape, color, and smell help flowers attract the right kinds of pollinators.

EVALUATE

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

- *Why do plants need to be pollinated?* (to make new seeds)
- *What is nectar?* (a sweet liquid found in many flowers)
- *Why is it important that plants make nectar?* (Many of the animals that pollinate flowers come to the flowers so they can drink the nectar.)

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

VOCABULARY ASSESSMENT: Pollination Nation

Record each vocabulary word and its definition.

Word	Definition

Write four sentences showing how the vocabulary words above are connected.
Use two different vocabulary words in each sentence.

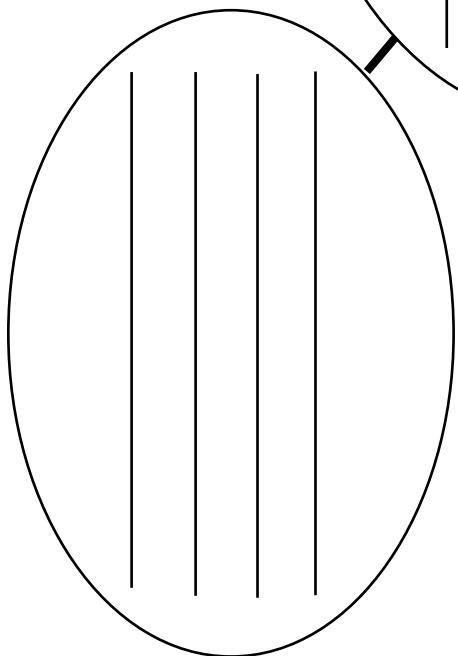
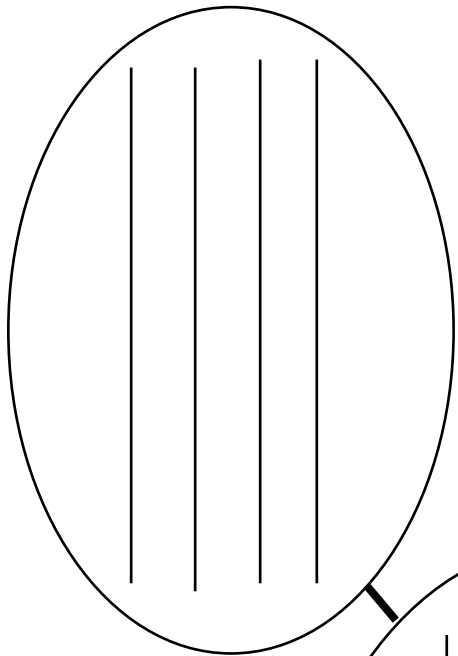
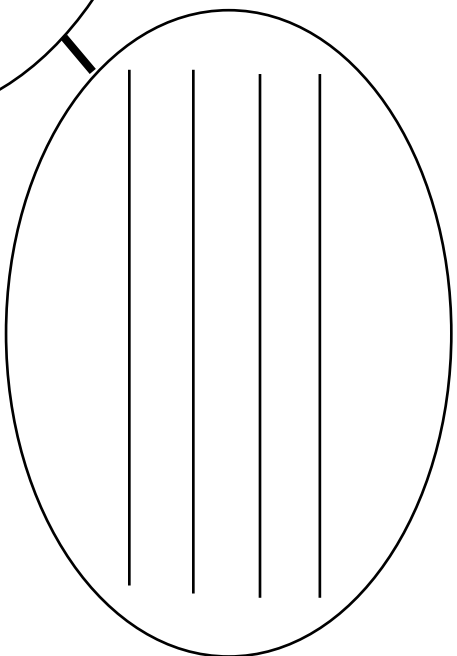
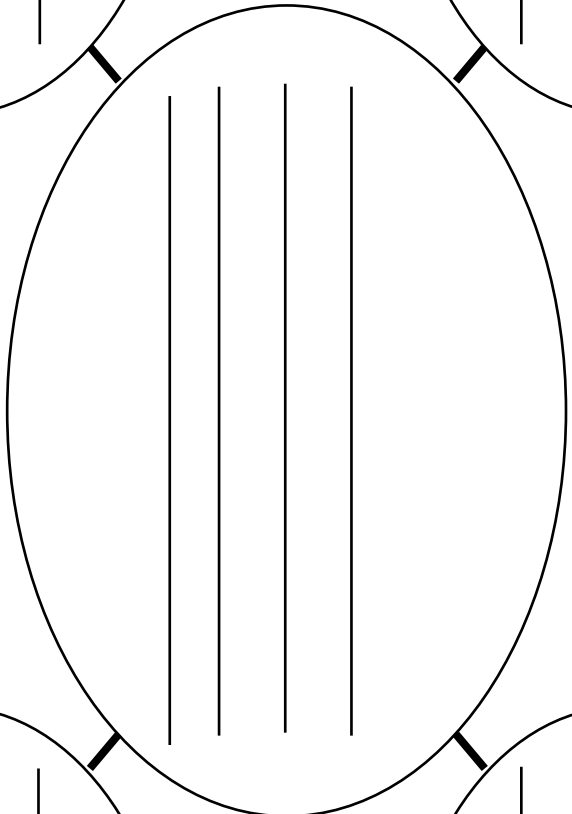
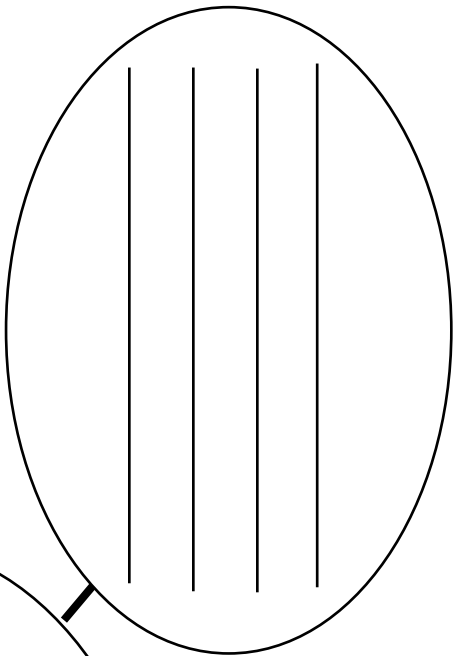
1. _____
2. _____
3. _____
4. _____

Name _____

Date _____

LANGUAGE ARTS ASSESSMENT: Pollination Nation

Write the main idea of the article in the middle circle. Pick four paragraphs. Write the main idea of each.

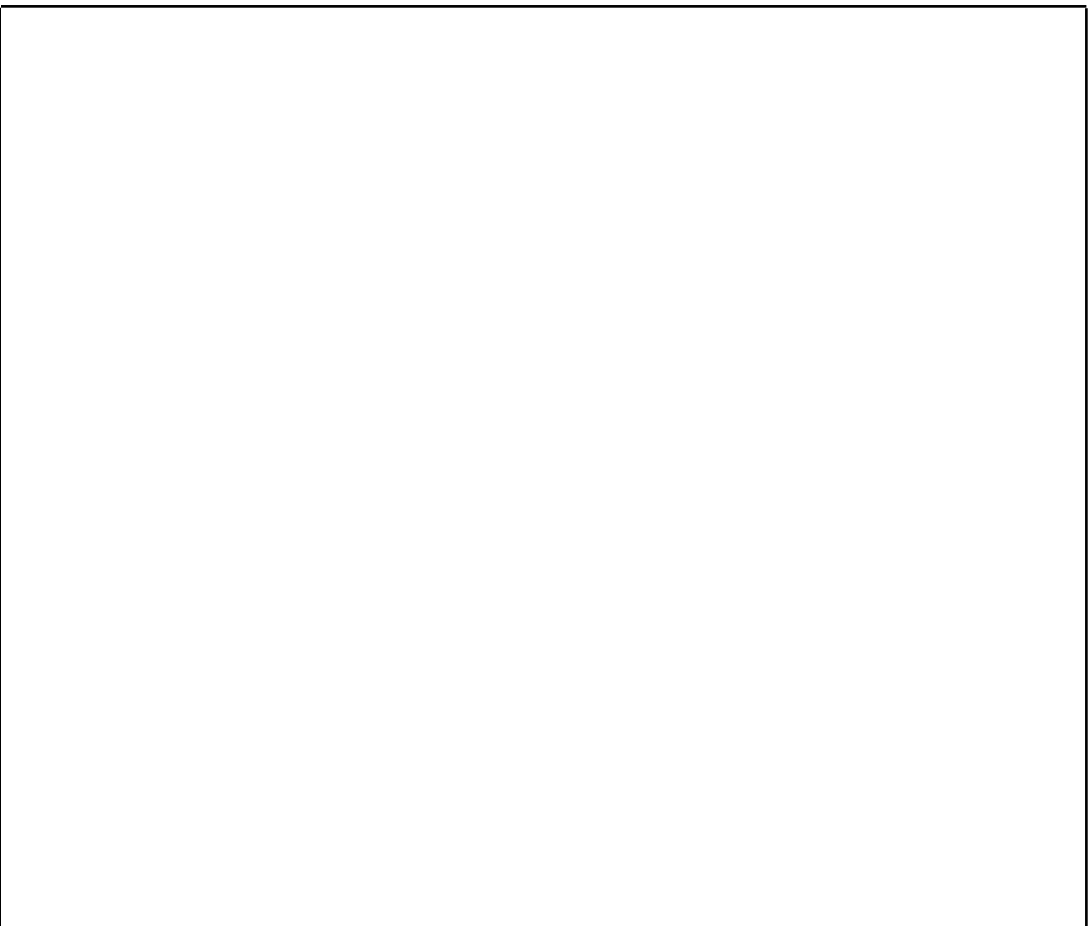


Name _____

Date _____

CONTENT ASSESSMENT: Pollination Nation

Identify one animal from the article. Draw a picture of the animal pollinating a flower. Describe what is happening. Then explain why plants need animals like this to survive.



Identify: _____

Describe: _____

Explain: _____

COMPREHENSION CHECK: Pollination Nation

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

- 1. Which substance causes plants to make seeds?
Ⓐ leaves
Ⓑ pollen
Ⓒ petals

- 2. What are animals looking for when they pollinate flowers?
Ⓐ nectar
Ⓑ seeds
Ⓒ blooms

- 3. How do bats move pollen from one flower to another?
Ⓐ They carry it in their mouths.
Ⓑ It sticks to their feathers.
Ⓒ It sticks to their fur.

- 4. What does a saguaro cactus use to attract bats?
Ⓐ stinky nectar
Ⓑ bright petals
Ⓒ tough leaves

5. Why do flowering plants need to be pollinated?

A New Twist on Tornadoes

LANGUAGE ARTS  500L

Standard Supported

- Know and use various text features to locate key facts or information in a text efficiently. (CCSS. RI.2.5)

Resources

- Vocabulary Assessment Master (page 15)
- Language Arts Assessment Master (page 16)

Summary

- The article "A New Twist on Tornadoes" examines the link between tornadoes and El Niño and La Niña, weather patterns that span the world.

BUILD VOCABULARY AND CONCEPTS

- **El Niño**
- **La Niña**
- **tornado**

Give each student a copy of the **Vocabulary Assessment Master**. Instruct students to record each vocabulary word as you read it aloud from the Wordwise feature on page 15.

Divide the class into pairs. Point out to students that they may have heard some or all of these words before. Using that background knowledge as a base, instruct partners to predict and write a definition for each word. Then have them write a sentence for each word, based on the definitions they wrote.

Display the Wordwise feature on page 15 of the projectable magazine. First, instruct students to make sure they spelled each word correctly. Then review the definitions as a class. Have students add these definitions to their worksheets. With their partners, have students write a new sentence for each word that accurately reflects how it was defined in the article.

READ

Display pages 10-11 of the projectable magazine.

Ask: *What are you going to read about in this article?* (tornadoes) Poll the class to see how many students used the headline to answer this question. Then take another poll to see how many students relied on the picture. Guide the class to recognize that headlines and photos are text features that help 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:** *I've seen lots of pictures of tornadoes. As this photo shows, they are violent storms. And, like the headline says, they twist or rotate as they move along the ground. But then I noticed the deck. It tells me something I didn't know. Scientists have found a link between tornadoes and another weather pattern. That's an important fact, and it was easy to find because it's in large type in the deck.*

Have students review the article to identify the subheads, diagram, map, bold print, glossary, photos, and captions. 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.

A New Twist on Tornadoes

LANGUAGE ARTS

TURN AND TALK

Have students turn and talk to discuss what they learned about tornadoes. **Ask:** *What is a tornado?* (a rotating column of air that extends from a cloud to the ground) *Where in the U.S. do the most tornadoes strike?* (the Midwest and the South) *Where is the safest place to be during a tornado?* (underground) Invite students to share what else they learned about tornadoes.

- **Predicting Definitions** Have students turn and talk to discuss what they learned about the article's vocabulary words in small groups. Encourage them to compare the before and after sentences they wrote for each word. As a class, examine how new knowledge contributes to students' understanding of each word.

- **Using Text Features** After reading the article, divide the class into small groups. Instruct students to ask each other questions about tornadoes. 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 tornadoes in the article.

WRITE AND ASSESS

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

- *What happens during a tornado?*
- *How can you stay safe during a tornado?*
- *What surprised you about what you read?*

A New Twist on Tornadoes

SCIENCE

Standard Supported

- Wind and water can change the shape of the land. (NGSS.2-ESS2-1)

Resources

- Content Assessment Master (page 17)
- Comprehension Check (page 18)

Science Background

A tornado is a vertical funnel of rapidly rotating air that is born out of a thunderstorm. The funnel extends from the clouds to the ground. Its winds can swirl up to 480 kilometers (300 miles) per hour.

Tornadoes form when warm, humid air collides with cold, dry air. As the warm air rises through the cold, an updraft forms. It begins to rotate and gains speed. Most tornadoes strike in the spring. And while they can occur at any time of day, they are most common in late afternoon. This is, not coincidentally, also prime time for thunderstorms.

Thanks to Doppler radar, meteorologists can usually warn people about 13 minutes before a tornado strikes. But researchers are constantly searching for better ways to predict when tornadoes will occur. One method is to study El Niño and La Niña, which are global weather patterns connected to the temperature of waters in the eastern tropical Pacific Ocean.

During El Niño, ocean currents are unusually warm. This brings heavy rain, flooding, and more tornadoes in Florida, south Texas, and the Gulf Coast. La Niña is the opposite. Its cold ocean temperatures push warm surface water further west than usual. As the warm, moist air flows into the Midwest, more tornadoes form there. Studying global weather patterns like these could help people predict the likelihood of tornadoes in any given season.

ENGAGE

Tap Prior Knowledge

Instruct students to imagine that they are outside. All of a sudden, the winds are blowing hard. They can hear a hissing sound and see spinning clouds. Encourage students to describe what they would do if they ever found themselves in a situation like this.

EXPLORE

Preview the Lesson

Display pages 10-11 of the projectable magazine. Give students a moment to examine the headline and photo. **Ask:** *Besides the headline, what leads you to think that this is a photo of a tornado?* Encourage students to share their ideas. Then read aloud the deck. As a class, brainstorm ideas about the type of weather pattern that could be linked to tornadoes.

Set a Purpose and Read

Have students read the article in order to understand what tornadoes are, why most tornadoes occur where they do, and how tornadoes could be connected to a weather pattern.

EXPLAIN

Understanding How Tornadoes Form

Display pages 12-13 of the projectable magazine. Ask students to point out similarities between the tornado in the photograph on page 12 and the one in the illustration on page 13. Then review the diagram "How a Tornado Forms" with the class. Use the red (warm air) and blue (cold air) arrows to help students understand how warm and cold air move and trade places as a tornado forms.

Recognizing Where Tornadoes Occur

Display pages 14-15 of the projectable magazine.

Ask: *Why is the yellow area on this map known as "Tornado Alley?" (That's where most tornadoes happen in the Midwest.) What other part of the U.S. has lots of tornadoes? (the South) Discuss why. (Tornadoes occur when warm and cold air meet. This happens a lot in the Midwest and South. Cold, dry air comes down from the North. Warm, moist air comes up from the Southeast. Hot, dry air comes up from the Southwest.)* **Say:** *When these different types of air meet, they can form a supercell. That's a big thunderstorm that can lead to a tornado.*

Linking Tornadoes to Global Weather Patterns

Display pages 14-15 of the projectable magazine. Review the section "Terrible Tornadoes." Discuss the difference between El Niño and La Niña. (During El Niño, the surface waters of the Pacific Ocean are warmer than usual. During La Niña, they're cooler.) Remind students that warm and cold air must meet for a tornado to occur. **Say:** *During La Niña, more warm, wet air reaches the Midwest. So during La Niña years, there are more tornadoes in the Midwest. But during El Niño, that warm, wet air stays in the South, leading to more tornadoes there.* Divide the class into small groups. Give each student a copy of the **Content Assessment Master**. Instruct groups to identify each sentence as true or false. If a statement is false, challenge them to explain why.

ELABORATE

Find Out More

Display page 14 of the projectable magazine. As a class, discuss what it would have been like to have been in this house when the tornado struck. **Ask:** *What could you have done to stay safe?* Invite students to share their responses. Remind students that the safest place to be during a tornado is underground. As a class, discuss what students should do if a tornado strikes while they are at school. Then have students interview their parents or other family members to find out what they should do if a tornado strikes while they are at home. Invite students to share their plans with the class.

Extend Your Thinking About Tornadoes

Display pages 14-15 of the projectable magazine. Point out that only a small part of the U.S. is located in "Tornado Alley." Point out that while this is where most tornadoes in the U.S. happen, every state has had at least one tornado. Challenge students to explain why. (Tornadoes occur where warm and cold air currents spin together. If conditions are right, this can happen anywhere.)

EVALUATE

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

- *What is a tornado like?* (A tornado is a fast-moving column of spinning air.)
- *Why are tornadoes most common in the Midwest?* (This is where warm and cold air currents most commonly meet.)
- *What should you do if a tornado is coming?* (Get in an underground basement or a first floor room with no windows.)

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

Name _____

Date _____

VOCABULARY ASSESSMENT: A New Twist on Tornadoes

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

Word			
Predicted Definition			
Sentence			
Definition from the Article			
Sentence			

LANGUAGE ARTS ASSESSMENT: A New Twist on Tornadoes

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

Text Feature	Fact
subhead	
diagram	
map	
bold print	
glossary	
photo	
caption	

CONTENT ASSESSMENT: A New Twist on Tornadoes

Make a checkmark to show if you think each sentence is true or false.
If a statement is false, use information from the article to explain why.

Sentence	True	False	Explanation
1. A tornado can form when warm air and cold currents spin together.			
2. Most tornadoes in the U.S. occur in California.			
3. El Niño and La Niña are the same thing.			
4. During La Niña, warm, wet air stays in the South.			
5. During El Niño, there are more tornadoes in the Midwest.			

COMPREHENSION CHECK: A New Twist on Tornadoes

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

1. What is a tornado shaped like?
Ⓐ a cloud
Ⓑ a supercell
Ⓒ a funnel
2. Where is "Tornado Alley" located in the U.S.?
Ⓐ the Midwest
Ⓑ the South
Ⓒ the Southwest
3. When are surface waters of the Pacific Ocean warmer than usual?
Ⓐ during El Niño
Ⓑ during La Niña
Ⓒ every other year
4. Where is the safest place to be during a tornado?
Ⓐ in a house
Ⓑ underground
Ⓒ up a tree
5. Why do scientists think the Midwest could have more tornadoes this spring?

Standard Supported

- Determine the meaning of words or phrases in a text relevant to a grade 2 topic or subject area. (CCSS.RI.2.4)

Resources

- Vocabulary Assessment Master (page 23)
- Language Arts Assessment Master (page 24)

Summary

- The article "Clever Levers" introduces students to the lever, a type of simple machine, and explores how levers help people do work.

BUILD VOCABULARY AND CONCEPTS

- **effort**
- **fulcrum**
- **lever**
- **load**
- **simple machine**

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.

In small groups, have students brainstorm ideas about what each word might mean. Instruct them to write a definition for each word in their own words. Then display the Wordwise feature on page 21 of the projectable magazine. Have students record those definitions and compare them with the definitions they wrote.

READ

Inform students that the purpose of this article is to introduce them to a type of simple machine called a lever and explain how it helps people do work. Point out that as they read the article, they may see words they don't completely understand. *Say: A great way to figure out what these words mean is to study the words around them.*

Display pages 16-17 of the projectable magazine. Read aloud the headline and deck. Highlight the word *lever* in the headline. Then model how to examine this word in context. **Say:** *Whether you've heard the word "lever" before or not, you can figure out what it means if you search for clues. For example, look at the four big words in the deck: push, swing, lift, and squeeze. These words must be big for a reason. Maybe they're things you can do with a lever.* Highlight the second sentence in the deck. **Say:** *It says here that levers help you do work. Maybe you can do that by pushing, swinging, lifting, and squeezing a lever.*

Give each student a copy of the **Language Arts Assessment Master**. Instruct students to read the article with a partner. As partners read, tell them to record two words they don't fully understand. Encourage partners to search for clues that help them understand the meaning of each unfamiliar word. After reading the article, instruct partners to write a definition for each new word.

Clever Levers

LANGUAGE ARTS

TURN AND TALK

Have students turn and talk to discuss what they learned about levers. **Ask:** *What is a lever?* (a bar, rod, or other object that turns on a fixed point) *What is that fixed point called?* (the fulcrum) *What is one thing a lever can help you do?* (Possible response: lift heavy loads) Encourage students to share other interesting facts they learned about levers.

- **Understand Definitions** Poll the class to see how many students feel that they are more familiar with the article's vocabulary words now that they have studied the definitions. **Say:** *One way to see if you fully understand a new word or idea is to try to tell someone else about the topic. If you can't explain the idea, you might need to read the article again.* Have students turn and talk to define each vocabulary word in their own words to a partner. Encourage them to better explain each word by giving details and examples from the text. Prompt discussion with questions such as: *What is effort? Can a push be effort? How about a pull? Why?*

- **Strengthen Understanding** Inform students that it is essential for readers to understand unfamiliar words when they read, particularly when reading about science-related topics. Without that knowledge, it's very difficult to understand the text. **Say:** *Once you understand what a word means, it's easier to use that word in a sentence. A little bit of background knowledge is all you need.* Challenge students to make accurate statements using each of the vocabulary words as well as the two unfamiliar words they investigated as they read the article. Encourage them to use their **Vocabulary Assessment Masters** and their **Language Arts Assessment Masters** as resources. But remind them to be original. Students should not restate sentences from the article. They should create new sentences of their own.

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 a simple machine?*
- *Why is a lever a simple machine?*
- *What surprised you about what you read?*

Standard Supported

- Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (NGSS.K-2-ETS1-2)

Resources

- Content Assessment Master (page 25)
- Comprehension Check (page 26)

Science Background

When people think of machines, they generally picture complicated gadgets with lots of moving parts. But not all machines are this complex. Some, called "simple machines," only have a few parts. And they are extremely helpful when you want to get work done.

In this article, the first of a six-part series about simple machines, students will learn about levers. A lever is a bar, rod, or other object that turns on a fixed point called a "fulcrum."

When someone or something pushes or pulls on a lever, that force, or effort, is transferred. This allows a relatively small force to lift a heavy load.

There are three types, or classes, of levers. With first-class levers, such as a seesaw, the fulcrum is located between the effort and the load. Effort and load move in opposite directions. Second-class levers, like wheelbarrows, place the load in the middle. Effort and load move in the same direction.

A baseball bat is a third-class lever when you swing it. The end of the bat you hold is the fulcrum. The effort is in the middle. The point at which the ball strikes the bat is the load. The force you apply moves the ball a long distance.

ENGAGE

Tap Prior Knowledge

Poll the class to see how many students think you can lift a dictionary with one finger. Once the tally has been taken, lay a fat marker on a desk at the front of the room. Center another book horizontally across the marker to create a seesaw. Place the dictionary on one end of the book. Press down on the other end of the book with one finger. Encourage students to discuss how you lifted the dictionary with one finger.

EXPLORE

Preview the Lesson

Display pages 16-17 of the projectable magazine. Read aloud the headline and deck. Inform students that this article is about levers. **Ask:** *What clues on these pages show or tell you what a lever is?* (The diagram on the left side of the screen contains a basic illustration of a lever. The caption at the top of the diagram states that a lever is a type of simple machine. The deck says levers make it easy to do work.) Challenge students to find the lever in the photo of the boat (the oars). Brainstorm ideas about how the oars help the rowers do work.

Set a Purpose and Read

Have students read the article in order to understand what levers are and identify different types of levers that help people do work.

EXPLAIN

Understanding Levers

Display pages 18-19 of the projectable magazine. Read aloud the problem and solution in the yellow box. Have students compare what they heard to what they see in the illustration. Remind students that a lever is a bar, rod, or other object that turns on a fixed point. As a class, identify the lever (crowbar), fulcrum (brick), effort (woman pushing down on the crowbar), and load (rock) in the example. If needed, review the Wordwise feature to reexamine what those words mean. **Ask:** *What work is this lever helping the woman do?* (lift the rock)

EXPLAIN

(continued)

Identifying Different Types of Levers

Display pages 20-21 of the projectable magazine. As a class, review the three types of levers. Using the illustrations as a guide, work together as a class to identify the load, effort, and fulcrum in each photo. Give each student a copy of the **Content Assessment Master**. Instruct students to draw a picture of someone using a lever. Then, working with a partner, challenge students to answer questions about the lever and how it helps people do work more easily.

ELABORATE

Find Out More

Divide the class into small groups. Provide the necessary supplies as students complete the activity on pages 22-23 of their student magazines. Once all catapults are complete, discuss the results. **Ask:** *What happened when you changed the position of the fulcrum?* (It should have changed the distance the marshmallows traveled.) Brainstorm ideas about other ways the catapult could be changed. Challenge students to explain how those changes would affect the catapult's ability to do work.

Extend Your Thinking About Curiosity

Display the National Geographic Learning Framework feature on the back cover of the magazine. Discuss what curiosity is. Tell students that curious people want to know how the world works. To figure things out, they can read what other people have to say or they can go out and find the answers on their own. Point out to students that they may not have known a lot about levers before reading the article "Clever Levers." But now that they do, they can think about the tools they use each day. Instruct students to make a list of all the tools they use. How many are levers? Give them time to either draw or take pictures of the levers they use. As a class, discuss how different levers students use help them do work.

EVALUATE

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

- *How many classes of levers are there?* (three)
- *What is a fulcrum?* (a fixed point on which a lever rests and moves)
- *Where is the fulcrum in a first-class lever?* (between the effort and the load)

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

Name _____

Date _____

VOCABULARY ASSESSMENT: Clever Levers

Record what you know about each vocabulary word and how the word is used in the article.

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:

LANGUAGE ARTS ASSESSMENT: Clever Levers

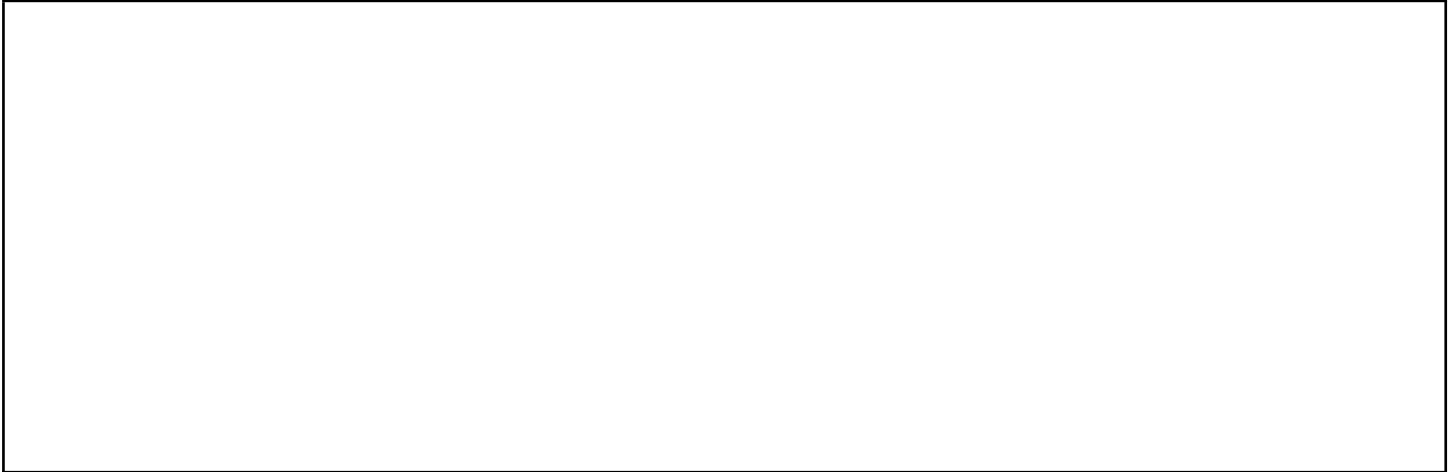
Record two unfamiliar words from the article. Write clues that help you understand what they mean. Then write a definition for each word.

Word	
Clues	
Definition	

Word	
Clues	
Definition	

CONTENT ASSESSMENT: Clever Levers

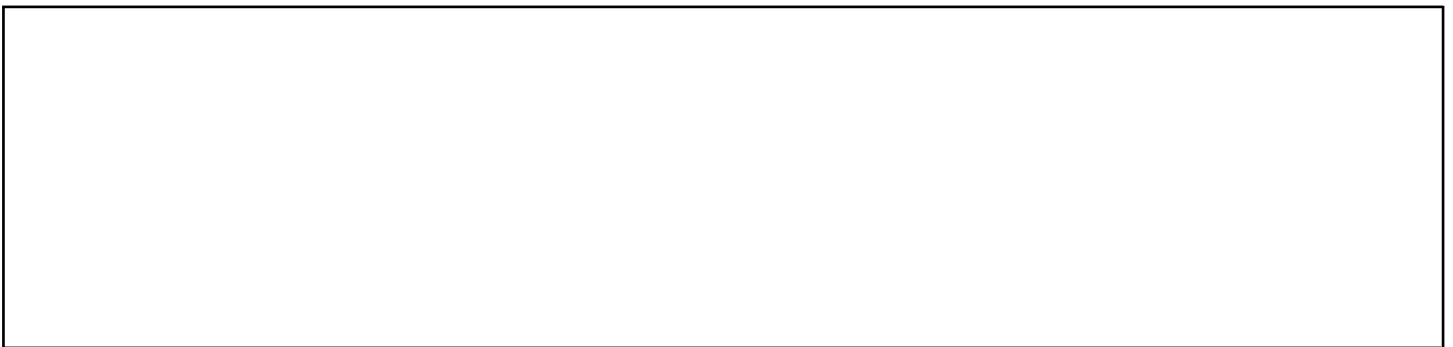
Draw a picture of someone using a lever. Then answer the questions.



1. What is the lever in your drawing? _____

2. What type of lever is it? first-class second-class third-class

3. Draw a diagram of your lever. Label the load, fulcrum, and effort.



4. How does the lever help you do work? _____

COMPREHENSION CHECK: Clever Levers

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

1. What is a lever?
 Ⓐ work you have to do
 Ⓑ a type of simple machine
 Ⓒ a fulcrum

2. What is a fulcrum?
 Ⓐ a force
 Ⓑ a fixed point
 Ⓒ a machine

3. Which of these objects is a first-class lever?
 Ⓐ seesaw
 Ⓑ door
 Ⓒ shovel

4. In which class of lever is the effort between the load and the fulcrum?
 Ⓐ first-class
 Ⓑ second-class
 Ⓒ third-class

5. Name one lever. Describe how it helps you do work.

Understanding Maps

ASIA

Standard Supported

- Identify some cultural and environmental characteristics of specific places. (NCSS. D2.Geo.6.K-2)

Resources

- Content Assessment Master (page 28)
- Comprehension Check (page 29)
- Asia Physical Map poster (teacher's edition)
- Asia Political Map poster (teacher's edition)

Social Studies Background

Spatial thinking is an essential skill for students to develop as they learn about geography and Earth and environmental sciences. Developing spatial concepts takes time and practice. Recognizing that, each month Explorer magazine will introduce students to a new set of physical and political maps. Use the accompanying lessons to guide students as they learn to recognize spaces and places in the natural world.

ENGAGE

Tap Prior Knowledge

Instruct each student to draw a picture of something they would expect to see in Asia. Invite students to share their drawings with the class. Discuss how the drawings relate to Asia.

EXPLORE

Preview the Lesson

Display the **Asia Physical Map poster** and the **Asia Political Map poster**. Cover the captions. Have students examine the photos. As a class, discuss what each photo tells about Asia.

Set a Purpose and Read

Have students examine the posters in order to understand that physical and political maps can be used to describe the cultural and environmental characteristics of a location.

EXPLAIN

Explore the Physical Map

Display the **Asia Physical Map poster**. Read aloud the text in the "Landforms" box on the left side of the poster. As a class, locate the Arabian Desert and the Gobi. Which is in the east (Arabian Desert) and which is in the west (Gobi)? Review the other boxes, photos, and captions. **Ask:** *What kind of landform is in the most northern parts of Asia?* (tundra) As a class, use the map to explore other physical characteristics of Asia.

Explore the Political Map

Display the **Asia Political Map poster**. Invite volunteers to read aloud the captions and the text in the boxes on the left side of the poster. Have them find each location mentioned on the map. Invite students to share interesting facts they know about other cities and countries shown on the map.

ELABORATE

Find Out More

Inform students that people use maps to see where things are located. **Say:** *But in order to read a map correctly, you need to know how to follow directions.* **Ask:** *What other feature could the designer have included on these maps to help people follow directions?* (a compass rose) Discuss what a compass rose is and how it helps people read maps.

Extend Your Thinking About Asia

Give each student a copy of the **Asia Maps Content Assessment Master**. In small groups, have students identify each country in Asia. Then, using the map and compass rose as resources, challenge them to list the correct direction or country name to complete each sentence.

EVALUATE

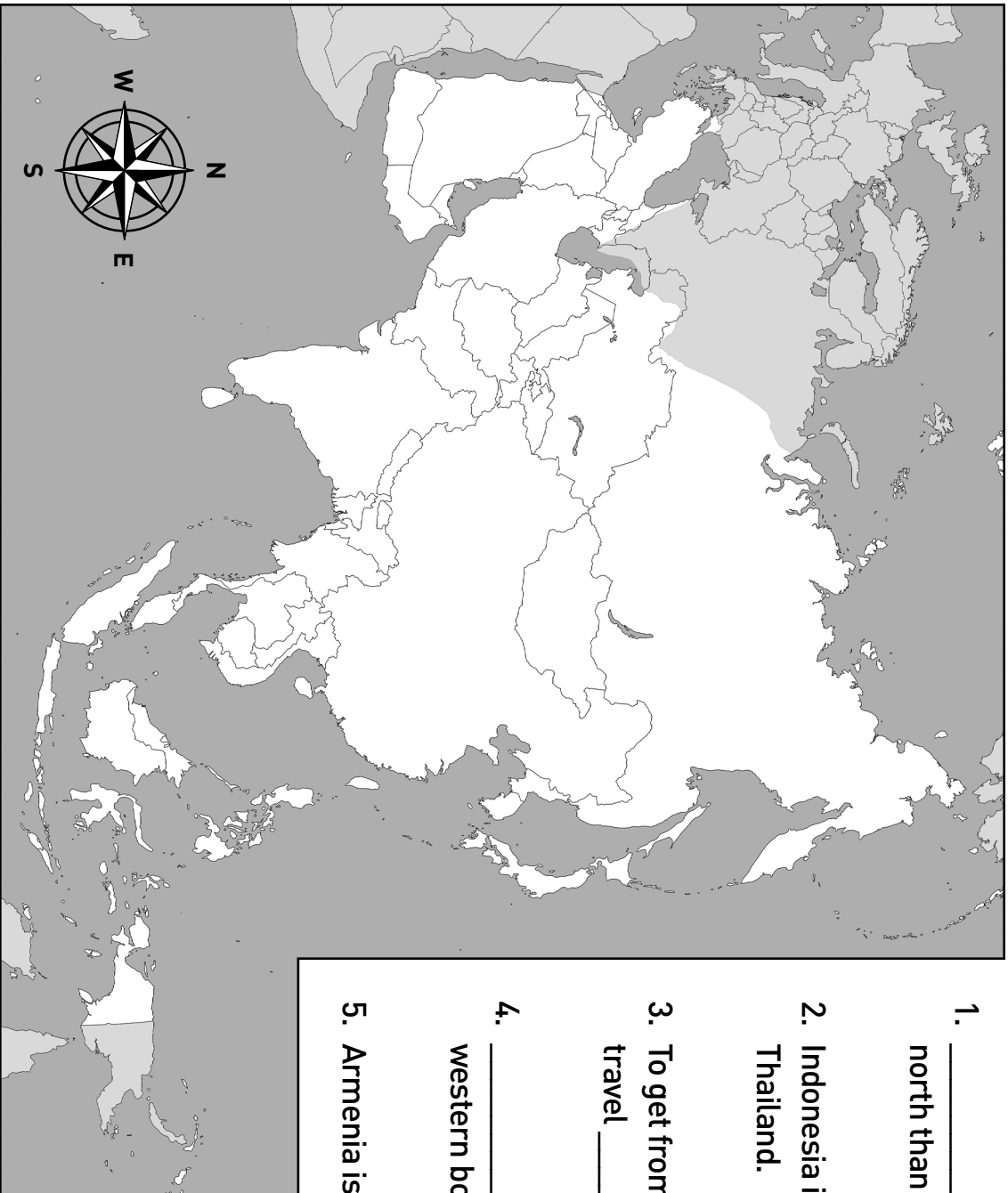
Have students ask and answer questions about the physical and political maps. If you wish, have them complete the **Comprehension Check** to assess their knowledge of Asian geography.

Name _____

Date _____

CONTENT ASSESSMENT: Asia Maps

Identify each country in Asia. Then add a country name or direction to complete each sentence.



1. _____ is located further north than any other country in Asia.
2. Indonesia is _____ of Thailand.
3. To get from Saudi Arabia to China, you must travel _____.
4. _____ is on Thailand's western border.
5. Armenia is _____ of Iran.

COMPREHENSION CHECK: Asia Maps

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

1. What is the smallest country in Asia?

- Ⓐ Russia
- Ⓑ the Maldives
- Ⓒ China

2. Where is Angkor?

- Ⓐ Japan
- Ⓑ Iraq
- Ⓒ Cambodia

3. What is the Gobi?

- Ⓐ a tall mountain
- Ⓑ a famous temple
- Ⓒ a cold desert

4. Where is Mount Everest located?

- Ⓐ the Himalayan range
- Ⓑ the Arabian Desert
- Ⓒ the Yangtze River

5. Write three facts you learned about Asia.

Pollination Nation

Assess Vocabulary, page 7

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

nectar: a sweet liquid found in many flowers

pollen: a substance that causes plants to form seeds

pollinate: to transfer pollen from one flower to another

pollinator: an animal that transfers pollen from flower to flower

Sentences will vary depending on the connections students identify.

Assess Language Arts, page 8

Students should record the main idea of the article. (Bees and other animals help plants.) Additional responses will vary, depending on which paragraphs students choose to investigate.

Assess Content, page 9

Students should pick one animal from the article, identify it, draw a picture of it pollinating a flower, and describe how it does this. They should note the plants need animals like these to pollinate their flowers so they can make new seeds.

Comprehension Check, page 10

1. B; 2. A; 3. C; 4. A; 5. Possible response: Flowering plants need to be pollinated so they can make seeds. That's how they make new plants.

A New Twist on Tornadoes

Assess Vocabulary, page 15

Students' predictions and the sentences they write will vary. They should record the words and definitions from the Wordwise feature on page 15.

El Niño: the condition in which the surface waters of the Pacific Ocean are warmer than usual

La Niña: the condition in which the surface waters of the Pacific Ocean are cooler than usual

tornado: a rotating column of air that extends from a cloud to the ground

Assess Language Arts, page 16

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

Assess Content, page 17

1. True.
2. False: Most tornadoes in the U.S. occur in the Midwest and South. California is on the west coast.
3. False: During El Niño, water in the Pacific Ocean is warmer than usual. During La Niña, it's cooler.
4. False: During La Niña, warm, wet air moves into the Midwest.
5. False: During El Niño, there are more tornadoes in the South.

Comprehension Check, page 18

1. C; 2. A; 3. A; 4. B; 5. Possible response: The waters in the Pacific Ocean are cooler than usual. That means La Niña is returning. During La Niña, there are more tornadoes in the Midwest.

ANSWER KEY

(continued)

Clever Levers

Assess Vocabulary, page 23

Students should record the vocabulary words from the Wordwise feature on page 21, 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.

effort: the force that makes a simple machine do work

fulcrum: a fixed point on which a lever rests and moves

lever: a bar, rod, or other object that turns on a fixed point

load: an object that is to be moved or the work that is to be done by a lever

simple machine: a machine with no more than a few parts

Assess Language Arts, page 24

Answers will vary.

Assess Content, page 25

Answers will depend on the type of lever students choose to draw.

Comprehension Check, page 26

1. B; 2. B; 3. A; 4. C; 5: Answers will vary.

Asia Maps

Assess Content, page 28

1. Russia; 2. south; 3. east; 4. Myanmar (Burma); 5. north

Comprehension Check, page 29

1. B; 2. C; 3. C; 4: A; 5: Answers will vary.