TEACHER'S GUIDE

Trailblazer
Vol. 17 No. 6

In This Guide

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

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 Trailblazer will be within the 350-750L range.

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

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- Magazines
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National Geographic Learning Framework

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

A — *Attitudes*

National Geographic kids are:

CURIOUS 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.

S — *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.

K — *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.

Pollination Nation

LANGUAGE ARTS LEXILE 680L

Standard Supported

- Determine the main idea of a text; recount the key details and explain how they support the main idea. (CCSS.RI.3.2)
- Write narratives to develop real or imagined experiences or events using effective technique, descriptive details, and clear event sequences. (CCSS.W.3.3)

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

- **anther**
- **nectar**
- **ovule**
- **pistil**
- **pollen**
- **pollinate**
- **pollinator**
- **stamen**

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, discuss how the words are related. (i.e., The anther is at the top of the stamen.) 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. 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 or overall topic of the article. Everything in the article is connected to the main idea. Those ideas are supported by key details in the text.

Display pages 2-3 of the projectable magazine. **Say:** *When you read, the first thing you want to do is identify the main idea. In other words, you want to figure out what the article is about. Sometimes, that's easy. The photo might show you or the headline might tell you. Other times, it's not quite so obvious.* Highlight the article's headline. Invite students to share their ideas about what it might mean. Encourage students to offer any additional clues they see in the photo.

Then invite a volunteer to read aloud the deck. Give students a moment to scan the rest of the article. **Say:** *Pollination is a big topic. And like the deck points out, people often think of bees when they think about pollination. But according to the deck,lots of other animals pollinate flowers, too. That's what this article is about—all of those other animals that help flowers reproduce.*

Give each student a copy of the **Language Arts Assessment Master**. Tell students to record the main idea of the article. (Many different animals help flowers reproduce.) Point out that as they read, they may decide to expand their thoughts and revise what they have recorded as the main idea. Then have students read the article on their own. As they read, instruct students to record key 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 during pollination?* (Pollen from the male parts of one flower is moved to the female parts of another flower.) *What can a plant do after it has been pollinated?* (make seeds) Invite students to share what else they learned about pollination.

• **Identify and Support the Main Idea** Remind students that the main idea is the topic, or what something is about. A writer uses details to support the main idea. **Say:** *It's easy to fill a page with details. The challenge for writers is to pick details that are important. The challenge for readers is to recognize important details when they see them.* Have students share and compare their **Language Arts Assessment Masters** in small groups. Did they identify the same main idea? Did they record the same details? If not, which important details did students miss? As a class, discuss how the key details support the main idea of the article.

• **Writing A Narrative** Point out to the class that identifying the main idea and key details of an article helps readers understand what they're reading. It's also a great way to learn about a new topic. Instruct students to select their favorite animal from the article. Then, using the information on their **Language Arts Assessment Masters** as a guide, challenge them to write a story telling about a time that animal pollinated a flower. Remind students to include accurate descriptions, vivid details, and a clear sequence of events to help readers fully appreciate the experience.

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 "Give a Little, Take a Little" a good description of pollination?*
- *What surprised you about what you read?*

Pollination Nation

SCIENCE

Standard Supported

- Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles. (NGSS.3-LS1-1)

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. (bee) Then point out the yellow blob on the bee's leg. **Ask:** *What is this yellow stuff?* (pollen) *What is it doing on the bee's leg?* (The bee is either collecting pollen from the flower in the photo or carrying pollen from another flower to this flower.) **Ask:** *Why?* (That is how bees pollinate flowers.) Tell students that as they read the article they will learn more about pollination and the unusual variety of animals that pollinate flowers so the flowers can reproduce.

Set a Purpose and Read

Have students read the article in order to understand what pollination is and recognize unusual animals that pollinate flowers.

Pollination Nation

SCIENCE

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 transfer pollen from one flower to another when they pollinate flowers.) Guide students to recognize that this process is called "pollination." Display the diagram "Inside a Flower" on pages 4-5 of the projectable magazine. Review the parts of a flower with the class. Using the diagram as a guide, have students explain what happens during pollination. (A flower's petals attract pollinators. When pollinators visit, they pick up pollen from the anther, which is at the tip of the stamen. They take pollen to another flower's stigma, which is at the tip of the pistil. This pollinates the flower so it can reproduce and make seeds, which grow in the ovule at the bottom of the pistil.)

Compare and Contrast Pollinators

Display pages 2-3 of the projectable magazine. Highlight the deck. Emphasize that people often think of bees and other insects when they picture pollinators. But other types of animals—including birds, reptiles, and mammals—pollinate flowers, too. **Say:** *The result might be the same—the animal transfers pollen from one flower to another—but different types of animals pollinate flowers in different ways.* Give each student a copy of the **Content Assessment Master**. Then divide the class into pairs. Instruct partners to pick an insect, bird, reptile, and mammal from the article and describe how each animal pollinates flowers. Challenge them to explain how plants and pollinators help each other survive.

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. But some flowers are also built to attract specific pollinators. As a class, discuss how flowers use shape, color, and smell to 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.

- *What are the male parts of a flower?* (anther and stamen)
- *What are the female parts of a flower?* (pistil, stigma, ovule)
- *Why do some plants depend on animals for pollination?* (They need the animals to carry pollen from one plant to another.)

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

Name _____ Date _____

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

Record the main idea and key details from the article.

Main Idea
Key Details

Pick your favorite animal from the article. Write a story. Tell about a time that animal pollinated a flower.

Name _____ Date _____

CONTENT ASSESSMENT: Pollination Nation

Identify an insect, a bird, a reptile, and a mammal from the article.
Describe how each one pollinates flowers.

Identify	Describe
insect:	
bird:	
reptile:	
mammal:	

How do plants and pollinators help each other survive?

Name _____ Date _____

COMPREHENSION CHECK: Pollination Nation

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

1. What happens during pollination?
   - Ⓐ Pollen is made.
   - Ⓑ Pollen is destroyed.
   - Ⓒ Pollen is transferred.

2. Which plant part makes pollen?
   - Ⓐ anther
   - Ⓑ ovule
   - Ⓒ pistil

3. Which plant part receives pollen?
   - Ⓐ stamen
   - Ⓑ stigma
   - Ⓒ petal

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

5. How does pollination help both plants and animals survive?

_____

_____

_____

_____

A New Twist on Tornadoes

LANGUAGE ARTS LEXILE 650L

Standard Supported

- Use text features and search tools (e.g., key words, sidebars, hyperlinks) to locate information relevant to a given topic efficiently. (CCSS.RI.3.5)

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

- **air mass**
- **El Niño**
- **La Niña**
- **supercell**
- **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 a weather pattern that spans the world. 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 headline, subheads, diagrams, 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) *At what time of year do most tornadoes happen?* (in the spring) *What parts of the U.S. get the most tornadoes?* (Midwest and South) 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

- Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. (NGSS.3-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 and see a tornado approaching. Then read aloud the following quote: "...There was a strong gassy odor and it seemed that I could not breathe.... I looked up and saw right up into the heart of the tornado. There was a circular opening in the center...about 50 to 100 feet in diameter." 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 how a weather pattern that spans the world could be linked to tornadoes.

Set a Purpose and Read

Have students read the article in order to understand what tornadoes are, when and where they occur, and how they could be connected to global weather patterns.

A New Twist on Tornadoes

SCIENCE

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 When and Where Tornadoes Occur
Remind students that spring is the peak season for tornadoes and most tornadoes occur in the Midwest and the South. Point out these locations on a U.S. map as you discuss why. (Tornadoes occur when warm and cold air meet. During spring, cold, dry air comes down from the North. Warm, moist air comes up from the Southeast. Hot, dry air comes up from the Southwest. All of these winds meet in the Midwest and South.)

Linking Tornadoes to Global Weather Patterns
Display pages 14-15 of the projectable magazine. Review the section "Wicked Weather." Discuss what scientists know about El Niño and La Niña. (Both are global weather patterns. During El Niño, the surface waters of the tropical Pacific Ocean are warmer than usual. During La Niña, they're cooler.) **Ask:** *What have scientists noticed about these weather patterns and tornadoes?* (During El Niño there are more tornadoes in Florida, south Texas and the Gulf Coast. During La Niña, there are more tornadoes in the Midwest.) As a class, discuss why this connection occurs. (Tornadoes form where warm and cold air masses meet. During El Niño, the warm air stays further south than it does during La Niña, so that's where tornadoes would form.) 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. Guide students to understand that their options would vary depending on how much notice they had that the tornado was coming. Divide the class into small groups. Instruct groups to conduct research to learn more about how scientists predict tornadoes. Invite them to share what they learned with the class.

Extend Your Thinking About Tornadoes
Display page 15 of the projectable magazine. Review the diagram "The Tornado Scale" with the class. Then remind students about Will Keller, who they read about at the beginning of the article. **Ask:** *Based on Keller's experience, how likely is it that he saw an EF5 tornado?* Encourage students to share what they think.

EVALUATE

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

- *What is a supercell?* (a severe thunderstorm that rotates and may produce tornadoes)
- *What causes a supercell to form?* (Different air masses hit one another.)
- *How can this cause a tornado?* (If one air mass is warm and the other is cold, they can form a spinning tube of air that can rotate, tilt upright, start to spiral, and form a tornado.)

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					

Name _____ Date _____

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
headline	
subhead	
diagram	
bold print	
glossary	
photo	
caption	

Name _____ Date _____

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 air masses meet.			
2. Most tornadoes in the U.S. strike during winter.			
3. El Niño and La Niña are weather patterns based on the depth of water in the eastern tropical Pacific Ocean.			
4. During El Niño, there are usually more tornadoes in the Midwest.			
5. If the waters of the eastern tropical Pacific Ocean are cooler than usual, there may be more tornadoes in the South.			

Name _____ Date _____

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. When do tornadoes form?
   - Ⓐ during blizzards
   - Ⓑ during thunderstorms
   - Ⓒ on bright, sunny days

2. Which parts of the U.S. are most likely to have tornadoes?
   - Ⓐ Northeast and Northwest
   - Ⓑ Midwest and South
   - Ⓒ Southwest and North

3. What are El Niño and La Niña?
   - Ⓐ supercells
   - Ⓑ tornado scales
   - Ⓒ weather patterns

4. Which part of the U.S. is most likely to have a tornado during La Niña?
   - Ⓐ Midwest
   - Ⓑ South
   - Ⓒ Northeast

5. How does water temperature affect the formation of tornadoes in the U.S.?

_____

_____

_____

_____

Clever Levers

LANGUAGE ARTS LEXILE 590L

Standard Supported

- Determine the meaning of general academic and domain-specific words or phrases in a text relevant to a grade 3 topic or subject area. (CCSS. RI.3.4)

Resources

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

Summary

- The article "Clever Levers" introduces students to levers, 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.

Instruct students to write what they think each word means on their worksheets. 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 levers help people do work.

Give each student a copy of the **Language Arts Assessment Master**. Tell students that they have already been introduced to the article's vocabulary words. They will use this worksheet to explore the words in different ways.

Display the Wordwise feature on page 21 of the projectable magazine. Highlight the word *effort*. Instruct students to write *effort* in the center box of one of their word diagrams. Then have them record its definition. Encourage students to scan the article to find the bold word *effort* in the text. (page 19, column 2) Highlight the word on the screen.

Model how to explore the word's meaning**. Say:** *According to the definition, effort is the force that makes a simple machine do work. I know that a force is a thing and a noun is a person, place, or thing. That means that the correct part of speech to list here is noun.* Instruct students to write *noun* in the "Part of Speech" section of their diagrams.

Invite a volunteer to read aloud the paragraph in which the word "effort" appears. Point out that the paragraph reveals an important fact. You can push down to create force, or effort. Have students record this fact on their diagrams.

Have students read the article on their own. As they do, instruct them to record additional facts about effort. Have students explore the remaining vocabulary words and one additional word from the article in this same way. Challenge students to use what they learned to make logical connections between the words.

Clever Levers

LANGUAGE ARTS

TURN AND TALK

Have students turn an 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 concept, 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 go a step further by giving details and examples related to each word. Prompt discussion with questions such as: *What is effort? How do you create effort when you use a crowbar to lift a rock?*

• **Strengthen Understanding** Inform students that it is essential for readers to understand technical terms when studying science-related topics. Without that knowledge, it's very difficult to understand the text. **Say:** *Once you understand what a scientific 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. 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?*
- *Identify one lever you have used. How did it help you do work more easily?*
- *What surprised you about what you read?*

Clever Levers

SCIENCE

Standard Supported

- Define a simple problem that can be solved through the development of a new or improved object or tool. (NGSS.3-PS2-4)

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 comprehension strategy in the top right corner says levers help people get work done.) 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.

Clever Levers

SCIENCE

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 (the 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)

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, challenge students to identify the load, effort, and fulcrum in each photo. Then review the article to identify other examples for each type of lever. Make a list. (first-class: oars on boat, crowbar, screwdriver, seesaw, scissors; second-class: door, wheelbarrow; third-class: shovel, backhoe, baseball bat, tennis racket) Give each student a copy of the **Content Assessment Master**. Instruct students to draw a picture of someone using a lever. Challenge them 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. Encourage them to describe how the levers 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:

Name ______________________ Date ______________

LANGUAGE ARTS ASSESSMENT: Clever Levers

Use this organizer to explore each vocabulary word from a scientific point of view. Pick one more word from the article and investigate it, too.

Definition	Part of Speech
Word	
Connections	Facts

Definition	Part of Speech
Word	
Connections	Facts

Definition	Part of Speech
Word	
Connections	Facts

Definition	Part of Speech
Word	
Connections	Facts

Definition	Part of Speech
Word	
Connections	Facts

Definition	Part of Speech
Word	
Connections	Facts

Name _____ Date _____

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? _____

_____

_____

_____

Name _____ Date _____

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 effort?
   - Ⓐ a force
   - Ⓑ a fixed point
   - Ⓒ a machine

3. In which class of lever is the load located in the middle?
   - Ⓐ first-class
   - Ⓑ second-class
   - Ⓒ third-class

4. Which of these objects is a third-class lever?
   - Ⓐ seesaw
   - Ⓑ wheelbarrow
   - Ⓒ shovel

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

_____

_____

_____

_____

Understanding Maps

ASIA

Standard Supported

- Use maps of different scales to describe the locations of cultural and environmental characteristics. (NCSS.D2.Geo.3.3-5)

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, examine the map to see which desert is in eastern Asia (Arabian Desert) and which is in the west (Gobi). Review the other boxes, photos, and captions. **Ask:** *Where can you find Przewalski's horse?* (the grasslands of central Asia) Find the grasslands on the map. 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**. Have students work with a partner to 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.

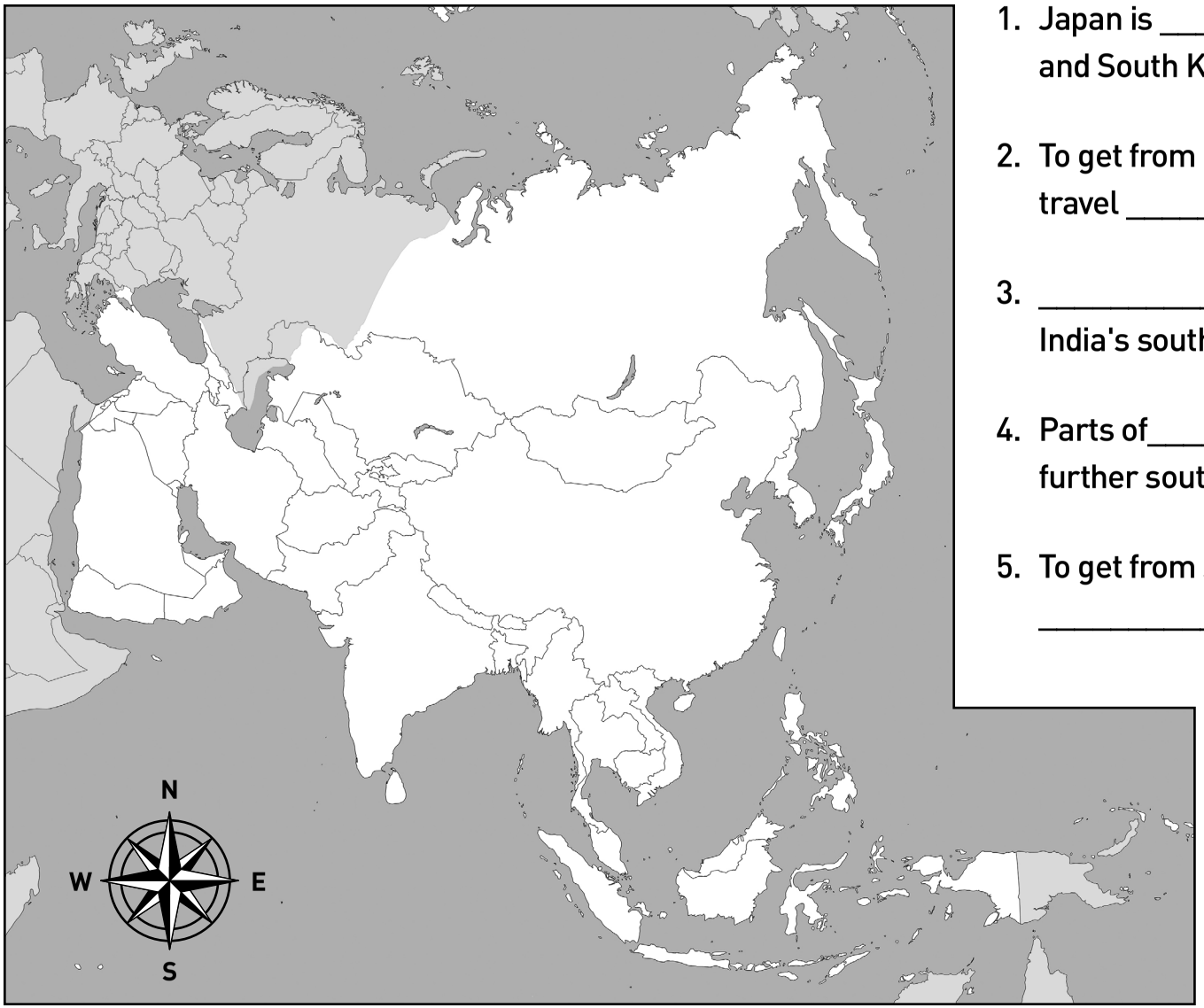
EVALUATE

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. Japan is _____ of North and South Korea.
2. To get from Thailand to Mongolia, you must travel _____.
3. _____ is just off of India's southern coast.
4. Parts of_____ are further south than any other country in Asia.
5. To get from Jordan to Yemen, you must travel _____.

Name _____ Date _____

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 largest country in Asia?
   - Ⓐ Russia
   - Ⓑ India
   - Ⓒ China

2. What is Angkor Wat?
   - Ⓐ a mountain
   - Ⓑ a temple
   - Ⓒ a river

3. Where in Asia can you find 7 percent of all plant species?
   - Ⓐ New Guinea
   - Ⓑ the Himalayas
   - Ⓒ the Arabian Desert

4. What is the longest river in Asia?
   - Ⓐ the Ural River
   - Ⓑ the Yellow River
   - Ⓒ the Yangtze River

5. Write three facts you learned about Asia.

_____

_____

_____

_____

Trailblazer

ANSWER KEY

Pollination Nation

Assess Vocabulary, page 7
Students should record the words and definitions from the Wordwise feature on page 9.

anther: a part of a flower that produces and contains pollen
nectar: a sweet liquid found in many flowers
ovule: a part of a flower that will become a seed
pistil: a part of a flower that holds the ovules
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
stamen: a part of a flower that is tipped with pollen

Sentences will vary depending on the connections students identify.

Assess Language Arts, page 8
Students may record the main idea identified before reading the article. (Many different animals pollinate plants.) Or, they may select one of their own. Key details will vary. Narratives should incorporate details and descriptions from the text and include a logical sequence of events.

Assess Content, page 9
Students should pick one insect, bird, reptile, and mammal from the article and describe how each one pollinates flowers. They should explain that plants need animals to transfer pollen so they can reproduce. Animals depend on plants for food.

Comprehension Check, page 10
1. C; 2. A; 3. B; 4: B; 5: Possible response: Pollination makes it possible for plants to reproduce. Animals get food when they pollinate flowers.

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.

air mass: a large region of air having similar properties
El Niño: the condition when the surface waters of the tropical Pacific Ocean are warmer than usual
La Niña: the condition when the surface waters of the tropical Pacific Ocean are cooler than usual
supercell: a severe thunderstorm that rotates; may produce tornadoes
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 spring.
3. False: El Niño and La Niña are weather patterns based on the temperature, not depth, of waters in the eastern tropical Pacific Ocean.
4. False: During El Niño, there are usually more tornadoes in the South.
5. False: If the waters are of the eastern tropical Pacific Ocean are cooler than usual, there will be more tornadoes in the Midwest. If they are warmer than usual, there will be more tornadoes in the South.

Comprehension Check, page 18
1. B; 2. B; 3. C; 4: A; 5: Possible response: When surface waters in the eastern tropical Pacific Ocean are warmer, or during El Niño, more tornadoes form in the southern U.S. During La Niña the water there is cooler and 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
Students should record words and definitions from the Wordwise feature on page 21 of the article. They should note the part of speech for each word, list facts, and make logical connections between vocabulary words. Students should investigate one word from the article that is not included in the Wordwise feature in this same way. All information should come from the article.

Assess Content, page 25
Answers will depend on the type of lever students choose to draw.

Comprehension Check, page 26
1. B; 2. A; 3. B; 4: C; 5: Answers will vary.

Asia Maps

Assess Content, page 28
1. east; 2. north; 3. Sri Lanka; 4. Indonesia; 5. south

Comprehension Check, page 29
1. A; 2. B; 3. A; 4: C; 5: Answers will vary.