MODULE 3

Natural Disasters

"Yes, a dark time passed over this land, but now there is something like light."

—Dave Eggers

Essential Question

How can learning about natural disasters make us safer?

Get Curious Video

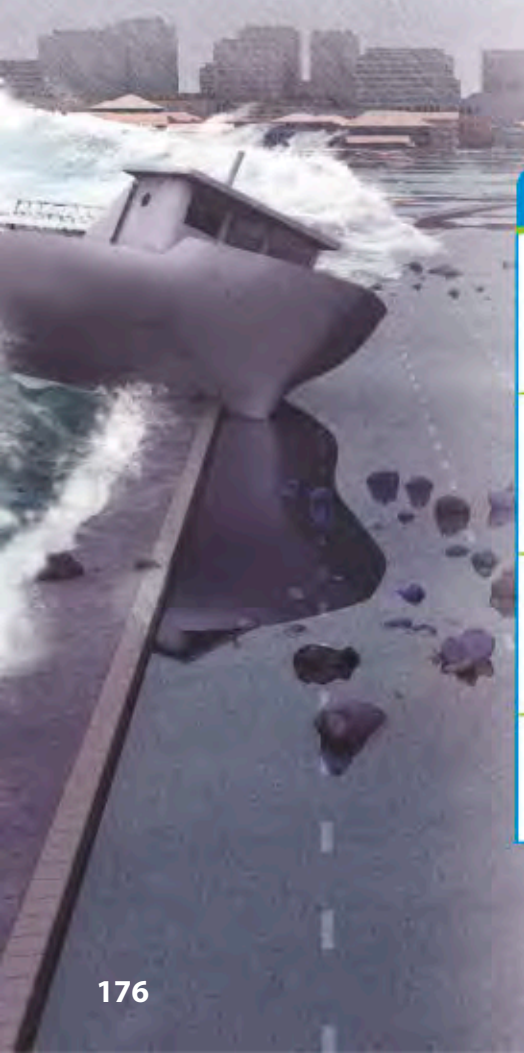
Big Idea Words

Words About Natural Disasters

The words in the chart will help you talk and write about the selections in this module. Which words about natural disasters have you seen before? Which words are new to you?

Add to the Vocabulary Network on page 177 by writing synonyms, antonyms, and related words and phrases for each word about natural disasters.

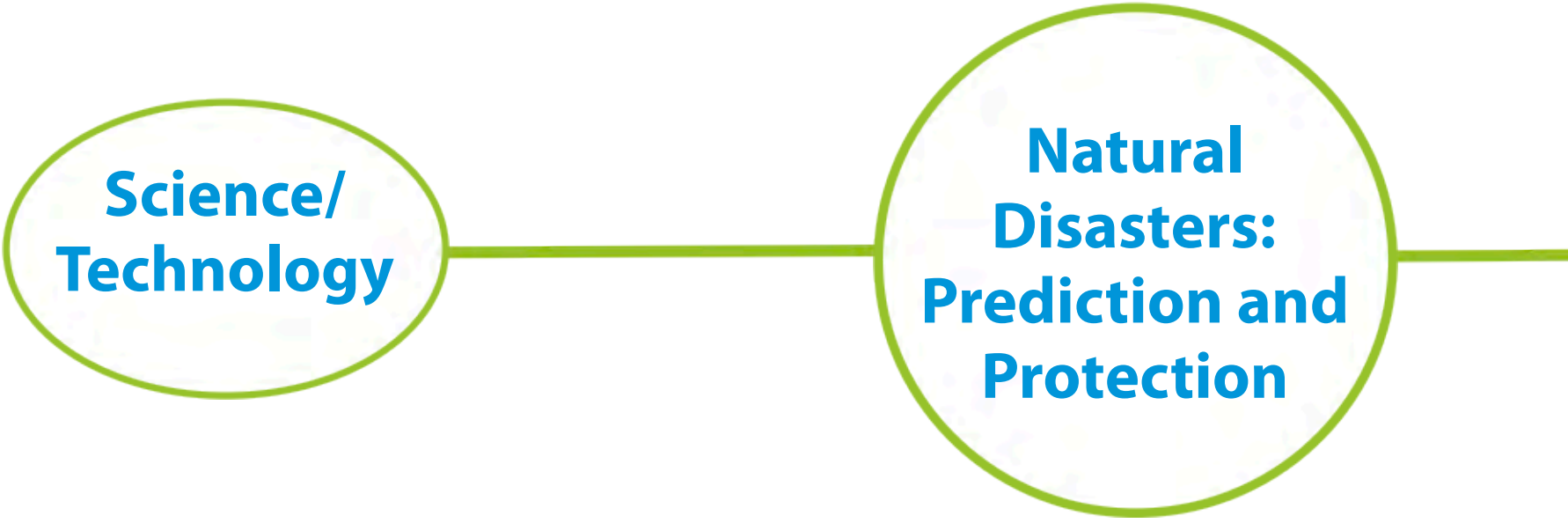
After you read each selection in this module, come back to the Vocabulary Network and keep building it. Add more boxes if you need to.



WORD	MEANING	CONTEXT SENTENCE
notable (adjective)	If something is notable, it is worth noticing.	The scientist measured a notable increase in the hurricane's strength.
spontaneous (adjective)	A spontaneous action is one that happens naturally and isn't planned.	She made a spontaneous decision to jump into the lake.
tremor (noun)	A tremor is a small earthquake or uncontrolled shaking in a body part.	The tremor that shook the town was minor and did little damage.
hazard (noun)	A hazard is a danger.	Watch out for the storm surge; it is a major hazard.


notable
spontaneous
Words About
Natural Disasters
tremor
hazard

Knowledge Map



Preparation

myNotes

Short Read

WHO STUDIES NATURAL DISASTERS?

October 23, 2018

Dear Professor Melendez,

1 I'm writing to ask your advice about careers that involve studying natural disasters. My earth science (my favorite subject!) teacher told me you teach college classes on natural disasters and suggested I send you a letter.

2 Last year, my family explored Kilauea, a volcano in Hawaii. As part of the tour, we saw firsthand how a breathtaking natural occurrence can also lead to disaster. Our guide explained that a notable eruption in 2014 almost destroyed the nearby town of Pahoa.

3 The tour made me really interested in volcanoes. What processes inside the earth cause them? Why do they erupt? Most importantly, how can science and knowledge be used to keep people safe from them?

4 We experience earthquake tremors in California sometimes and have to practice safety drills for them. The spontaneous shaking of the earth has always left me feeling both fascinated and scared! I've been reading about other natural disasters, too. I think the swirling winds and drenching rains of hurricanes are as thrilling as earthquakes. They can also be just as dangerous, right?

5 I want to understand these kinds of events and maybe help other people understand them better someday, too. What careers would let me apply knowledge of natural disasters to help people?

6 I'd very much appreciate your advice on jobs I might consider. Thank you for your time and advice!

Sincerely,

Robin Thiersson

Robin Thiersson
267 Seismo Street
Tectonic, California 00000

November 1, 2018

Dear Robin,

7 Thanks so much for your letter. It's so encouraging to me to hear of your interest in science and natural disasters. The world needs budding scientists like you!

8 Your fascination with natural disasters could lead you to any number of exciting careers. For example, a volcanologist studies volcanoes. (You may have met one during your tour of Kilauea.) Volcanologists often work at the site of an erupting volcano. They also spend time in labs analyzing data about the eruptions.

9 You probably know that no one can predict earthquakes, but scientists called seismologists help us prepare for these natural hazards. These scientists also work both in labs and at sites of seismic activity such as fault lines.

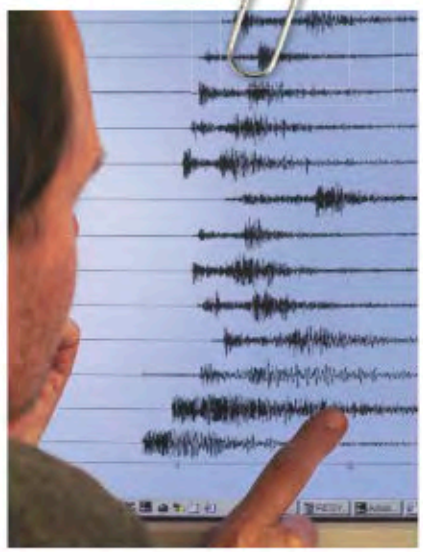
10 If you'd prefer the high winds and ocean storm surges of hurricanes, you may want to be a meteorologist. These scientists forecast the weather or study the atmosphere and the world's climate. Their knowledge and direction is invaluable in helping people stay safe during these mighty ocean storms. Hurricanes can be every bit as dangerous as eruptions and earthquakes; you're absolutely right.

11 I gathered data for a seismologist for a number of years before I began teaching. I'd be happy to share my experiences with you and your classmates!

Sincerely,

Judy Melendez

Professor Judy Melendez
Tectonic University
University Avenue
Tectonic, California 00000



Seismograms such as this one help people study seismic activity.

myNotes

Notice & Note
Numbers and Statistics

Prepare to Read

GENRE STUDY **Narrative nonfiction** gives factual information by telling a true story.

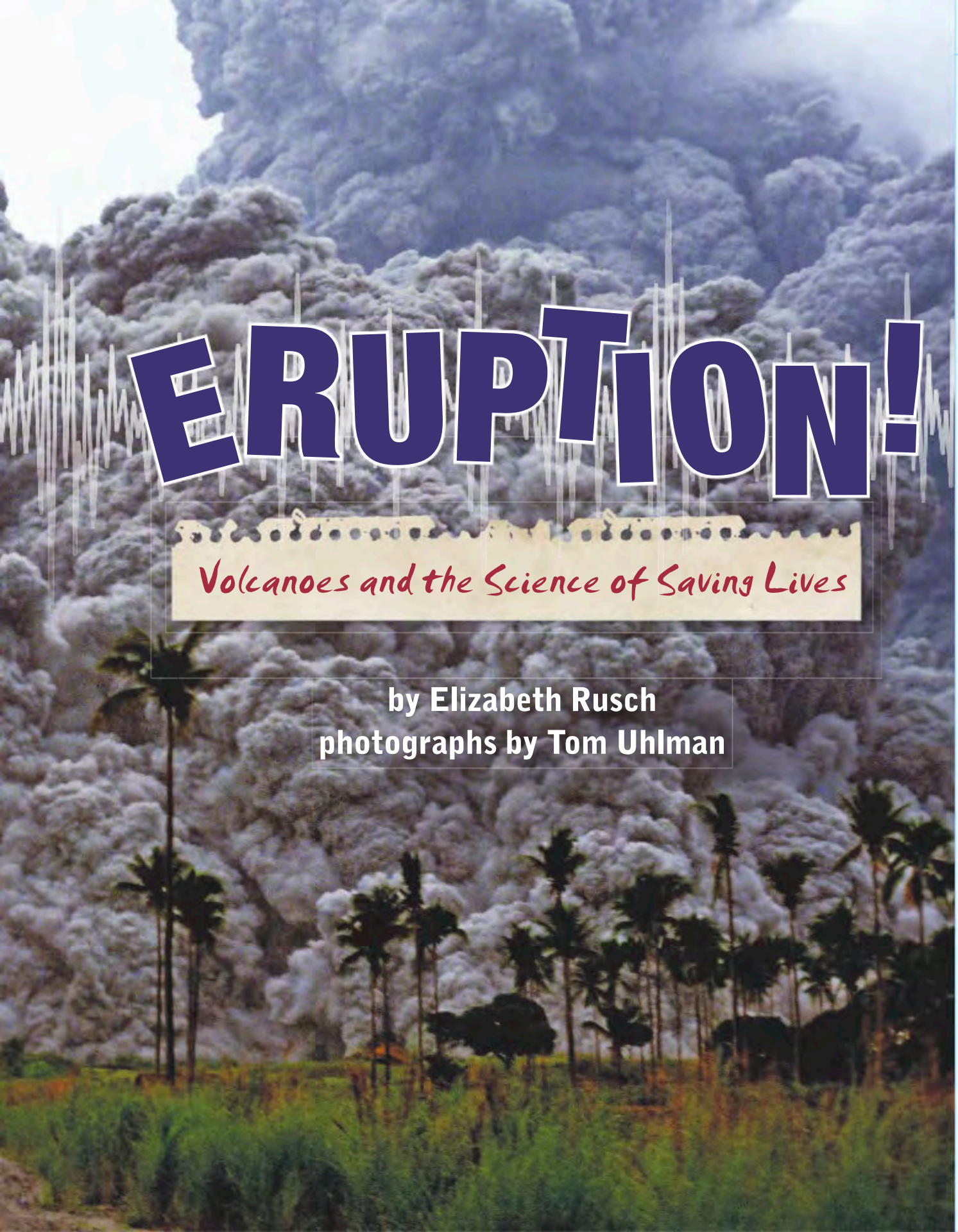
- Narrative nonfiction authors present events in sequential, or chronological, order. Doing so helps readers understand when events happened and how they're connected.
- Narrative nonfiction often includes visuals, such as photos. Captions help explain the photos and add details to the text.
- Texts written about events related to science or social studies may also include words that are specific to the topic.

SET A PURPOSE **Think about** the genre and title of this text. What do you know about volcanoes? What do you want to learn? Write your ideas below.

CRITICAL VOCABULARY

- seismographs
- evacuation
- reservoir
- conferring
- consequences
- widespread
- alarming
- victim

Meet the Author: Elizabeth Rusch



ERUPTION!

Volcanoes and the Science of Saving Lives

by Elizabeth Rusch
photographs by Tom Uhlman

myNotes

myNotes

1 *When the Colombian volcano Nevado del Ruiz erupted in 1985, United States Geological Survey (USGS) scientist Andy Lockhart was horrified by the tragedy. A year later, he became one of the earliest members of a volcano crisis team, called the Volcano Disaster Assistance Program (VDAP). The VDAP's mission is to bring equipment and knowledge to areas threatened by volcanoes in order to predict eruptions and prevent catastrophes. Six years after the program started, Chris Newhall, another VDAP scientist, got a call about steam shooting from Mount Pinatubo (peen-uh-TOO-boh), a mountain in the Philippines. Until this happened, most people thought Mount Pinatubo was a huge jungle-covered mountain, not a volcano. Chris knew it was serious. He and the team had to do something. He and fellow VDAP scientists Andy Lockhart and Rick Hoblitt set out to try to predict Mount Pinatubo's next move. They worked from Clark Air Base, very close to the volcano.*

2 **On May 28,** Chris got a new gas reading from Mount Pinatubo. Sulfur dioxide (SO_2) had jumped tenfold, to 5,000 tons a day. The volcano was definitely ramping up.

3 A few days later, instruments recorded two unusual earthquakes. A shallow, continuous, rhythmic shaking known as a low-frequency earthquake meant magma was moving toward the surface and releasing more gas. Then the seismographs recorded the first earthquake directly under the vent.

4 Over the next few weeks, the volcano spat steam higher and higher into the sky. The plume changed color from white to gray. Then the volcano began shooting rock and ash. But the geologists tested the ash and found no sign of fresh lava. The steam explosions were just tossing up old material. Would the volcano erupt, or would it just spit steam until it slipped back into dormancy[1]?

1 dormancy: the period during which a volcano is temporarily inactive

seismographs Seismographs are instruments that measure and record details about earthquakes, such as their strength and how long they last.

5 Then the sulfur dioxide plummeted, from 5,000 tons to 1,300 to 260 a day. That could mean the volcano was settling down.

6 Or . . . it could mean the volcano's vent was clogged, with pressure building.

7 Andy and the other scientists watched the seismograph around the clock. They saw bigger quakes, longer quakes, and a harmonic tremor, a constant humming earthquake that often means magma is rising and boiling away groundwater[2].

8 The Americans and Filipinos each had their own alert level systems. The VDAP scientists debated. Was it time to raise the alert level to three: high and increasing unrest; eruption possible in two weeks?

9 Ray, the head of the Filipino geologists, would need time to spread any warning to people scattered in villages all around Pinatubo. He raised his alert level to three: eruption possible in two weeks. About 10,000 members of the Aeta tribes[3] were moved to evacuation camps.

10 The quakes accelerated. Magma moving all along the conduit[4] was shaking the ground deep in the earth and quite near the surface. More and more steam and ash poured from cracks in the volcano, called fumaroles.

11 The volcanologists[5] estimated the size of the magma chamber (the reservoir of melted rock and gas under the volcano) and the potential size of the eruption. The eruption could be ten times larger than the 1980 eruption of Mount St. Helens, which was bigger than any living geologist had ever seen.

12 Military officers listened intently to the geologists' briefings. At the end of one, Major General William Studer asked: "What would you do?"

13 The scientists answered: "Move the dependents off the base."

14 The officers relocated pregnant women and the elderly. The air force newspaper and TV station began broadcasting details of an evacuation plan: what to bring and where to go.

2 groundwater: water found underground in the cracks in sand, soil, and rock
3 Aeta tribes: tribes of people native to the island of Luzon in the Philippines
4 conduit: a channel for moving some type of liquid
5 volcanologists: geologists who study active and inactive volcanoes

evacuation An evacuation is the act of moving from a dangerous area to a safer one.
reservoir A reservoir is a place where a supply of something is collected.

15 The earthquakes got even closer to the surface. A steam plume reached 28,000 feet (8,500 meters), the highest so far.

16 After **conferring** with VDAP scientists, Ray raised his alert to level four, enlarging the evacuation zone for the local population. Filipinos all around the volcano packed a few possessions and walked or rode carts down the mountain.

17 VDAP members debated: Should we move to level four? The air force had set VDAP's level four as a trigger for Clark to be evacuated. Evacuating 14,000 people and millions of dollars of equipment would be a huge challenge, and a huge burden to the military and their families.

18 Some VDAP members thought they should.

19 Then the earthquakes diminished.

20 "Volcanoes don't necessarily move from deep sleep to violent eruption in a straight, orderly progression," Andy said. "They ramp up and drop down, ramp up and drop down. The trend at Pinatubo was ramping higher and dropping down less. Any single episode of ramping up could lead to a full-blown eruption. But it could all just peter out to nothing." The scientists had to predict the unpredictable. The **consequences**—a costly false evacuation or tragic loss of life—weighed heavily on their minds and their hearts.

21 On June 8, a chopper lifted off to give scientists a closer view of the summit. The sky cleared. They could see that a big, ugly gray blob of rock had poked out of the east crater wall. It was a lava dome. Cold, hard, heavy rock could be clogging the vent. With magma moving up with nowhere to go and pressure building, this thing could blow—with deadly results.

22 The scientists told the air force commanders the new development and waited for them to take action.

23 Then, the next morning, June 9, when Andy and his colleague hopped into the helicopter, it took a detour—to the center of the base. General Studer and his second-in-command climbed aboard. The helicopter headed for the volcano.

24 Instead of billowing steam and ash, only a thin snake of yellow-gray plume drifted up from the summit.

25 "Geez, that's a lot of ash," the general commented.

conferring If you are conferring with someone, you are discussing an idea or trying to make a decision.

consequences Consequences are the outcomes or effects of events.

26 "That's nothing," the volcanologists said. They pointed out how underlying the jungle all around the mountain were signs of massive ancient pyroclastic flows[6]. "That's all ash from the last eruption." The helicopter turned, and the widespread devastation once wrought by this volcano became impossible to miss. The general stared silently out the window as the helicopter headed back to the base.

27 Finally, he turned to his second in command. "Do it tomorrow," he said.

6 pyroclastic flows: fast-moving flows of hot gas and rock

widespread If something is widespread, it happens over a large area or among many people.

"Volcanoes don't necessarily move from deep sleep to violent eruption in a straight, orderly progression."

Mount Pinatubo steams behind an air force helicopter.

myNotes

LOOKING FOR LUMPS

Changes in the surface of a volcano give clues about what is happening beneath. Imagine a mole tunneling under a lawn. When the mole moves, the grass bumps up. Magma moving underground does the same thing, actually lifting the ground above it. When magma is close to the surface, the bulge can grow hundreds of feet high and hundreds of feet wide.

Lava shoved out of an erupting volcano can also make a massive bulge or dome. Domes and bulges might plug a vent, causing pressure to build underground. Domes can also grow so large that they trigger landslides. So scientists have to track their growth, too.

How do scientists measure all these lumps and bulges? Digital elevation maps—compiled using photos and radar data—show the length, width, and height of every part of the volcano. Scientists compare DEMs compiled at different times to track how the shape of the volcano has changed. They can also makes these measurements using satellite radar images, GPS, meters that track how the ground tilts, or by careful surveying.

June 10, 1991

28 At 6 a.m., military television and radio echoed with the order to evacuate. The streets of Clark Air Base filled with cars, trucks, and buses that funneled downhill through the shantytowns[7] and toward a naval station an hour away. By noon, 14,500 people had evacuated.

29 The Filipinos extended their evacuation to twelve miles (20 kilometers), displacing 25,000 people. People with carts piled high with furniture and leading water buffalo shared the road with the long line of military trucks and the cars of people evacuating the base.

30 Left on the base were some officers, the Military Police (MPs), and engineers who could keep the lights on. The volcanologists moved their observatory to the farthest corner of the base. "We were just incredibly relieved that most everybody was out of the way," Andy said.

31 But the pressure still weighed on the scientists.

32 "I couldn't help second-guessing myself," said team member Dave Harlow. "All of us did. I was feeling as though the chances were pretty high that we would all be hauled in front of committees investigating the disastrous evacuation, its costs and impact to the Philippine economy and on the air force."

7 shantytowns: settlements on the outside of towns that consist of large numbers of run-down dwellings

People evacuating to avoid the dangers of the eruption.

"We were just incredibly relieved that most everybody was out of the way."

33 Would Mount Pinatubo really explode? The next few days would tell.

34 Andy woke up to a blue-sky morning on June 12. It was after 6 a.m., and the clouds had usually rolled in by then. But the sun shone brightly as he waited for geologist Rick Hoblitt, who was going to give Andy a lift to the observatory.

35 "LET'S GO!" Rick hollered from upstairs. *Geez,* Andy thought. *What's up with him?*

36 Rick raced down the stairs, taking two at a time, just as Andy opened the front door.

37 A huge black ash column pumped out of the volcano, filling the sky. The column rose up higher and higher. Rick and Andy jumped into their truck and raced off.

38 By the time they got to the observatory at the edge of the base, the ash column had hit the stratosphere. The cloud mushroomed out, reaching the sky right above them.

myNotes

39 Then the cloud slowed, stopped, and started to dissipate.

40 "Wahoo! Whoa! Cool!" the MPs hollered. They started doing a victory dance, because they thought they'd just seen the eruption and survived.

41 But Andy and Rick didn't dance. They turned to their instruments. They knew that this could be just the beginning.

42 For the next few days Pinatubo shot steam, rumbled, and kept the scientists on edge. Several times, the volcano shot up columns as big as the one on June 12.

Military personnel and their families evacuate Clark Air Base.

43 But on June 14, the volcano stopped shooting steam and ash. Pinatubo shook as much as it had two days before, but nothing came out. *The volcano is all stopped up,* Andy thought.

44 He fell asleep late that night, restless and worried. Then on June 15, Andy and other scientists were jolted from sleep by a cry.

45 "GET UP! GET UP!" yelled the scientist on watch.

46 Andy ran to the front door. Clouds obscured the top of the volcano and pelting rain blurred Andy's view. But great black ash clouds—massive, rolling clouds of superheated ash—raged down six miles (10 kilometers) on each side of the volcano.

47 Pyroclastic flows!

48 Moments later, rain and wind from a typhoon[8] that had hit the island completely hid the erupting volcano.

49 Andy rushed to the seismograph.

50 The earthquakes died down, way down, and stayed down.

8 typhoon: a dangerous, powerful tropical storm occurring in the western Pacific or Indian Oceans

51 "This is bad," Andy muttered.

52 The pressure under the volcano was building.

53 "Should we evacuate?" the scientists asked each other.

54 The decision was quick. Someone yelled: "EVACUATE THE BASE!"

55 Everyone started moving all at once, grabbing things, yelling. Officers, MPs, and scientists piled into cars and sped away.

56 From a big field, they watched the dark volcano. They waited.

57 The volcanologists wanted to see their instruments. They wanted to find out what this volcano was up to so they could extend the evacuation zone if needed, or learn something that would help at another crisis. But that would mean risking their own lives.

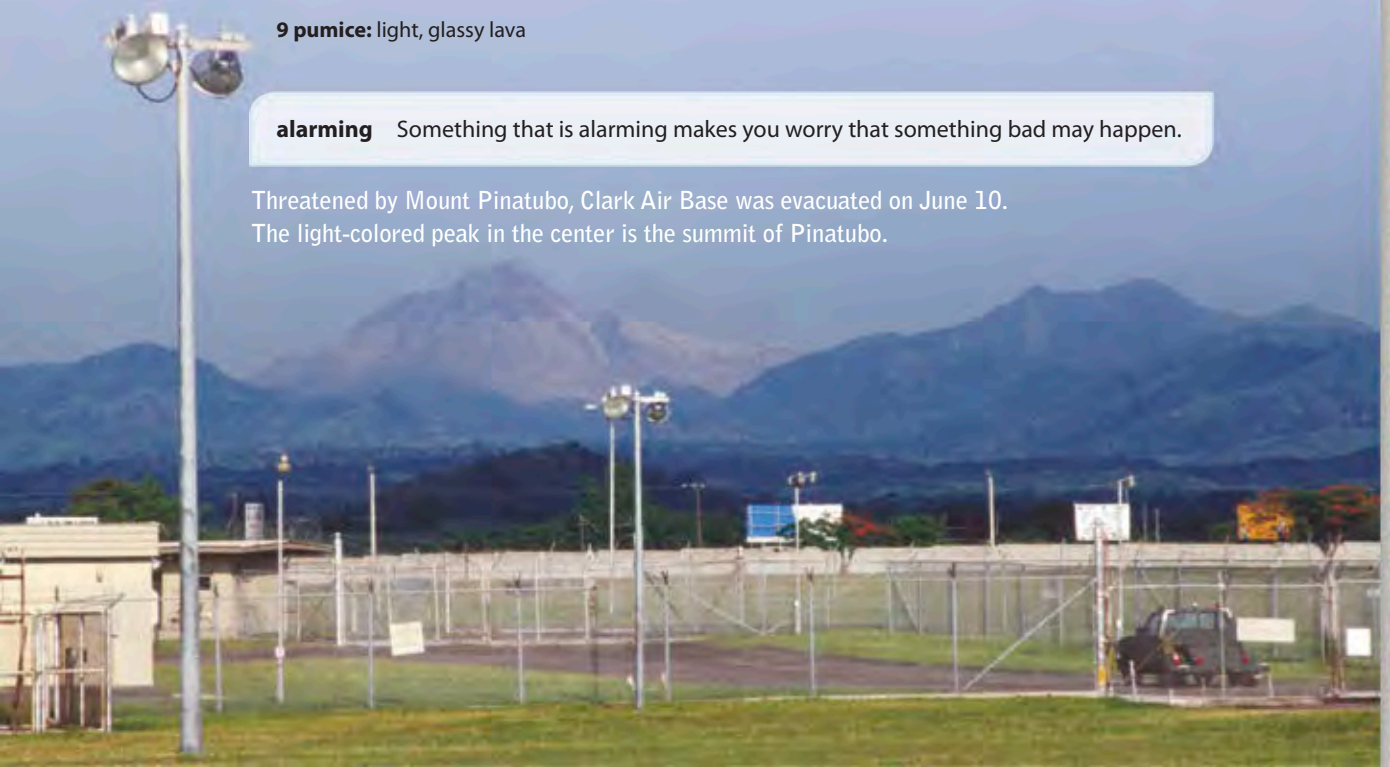
58 They decided they'd been too hasty evacuating themselves. They drove back to the observatory on the base, along with the base commanders.

59 It was raining. Not just water and ash, but egg-size chunks of pumice[9]. The scientists hurried into the building and crowded around the seismographs.

60 The earthquakes were so intense that the seismograph needles just banged from the top to the bottom of the drum, *TUNK, TUNK, TUNK, TUNK,* making alarming blocks of solid ink. Pinatubo blasted ash higher and higher. The scientists watched, aghast, as monitoring stations blinked out one by one on the far side of the volcano—destroyed. Then a station went down on their side.

9 pumice: light, glassy lava

alarming Something that is alarming makes you worry that something bad may happen.



Threatened by Mount Pinatubo, Clark Air Base was evacuated on June 10. The light-colored peak in the center is the summit of Pinatubo.

myNotes

The June 12, 1991, eruption of Mount Pinatubo, viewed from Clark Air Base.

"I had maybe twenty seconds to run to the back of the building. Maybe that would be enough protection."

61 That was only twelve miles (20 kilometers) from where they were standing.

62 Was a searing pyroclastic flow heading their way?

63 Flows moved at up to one hundred miles (160 kilometers) an hour. Did the scientists have only precious moments before they themselves fell victim to an eruption and raging, searing pyroclastic flows?

64 This time the scientists knew they had no time to evacuate. They raced for the back of the building, the farthest they could get from the erupting monster.

65 They waited, panting, sweating.

66 Andy could stand it no longer. He went back to the front door. All he saw was black—complete black—from the rain, the dark clouds, the ash fall. The sound was terrifying—like a wall of rock a mile high racing down at breakneck speeds.

67 *I could die,* Andy thought. *All my friends could die.*

68 He watched and he watched, his eyes glued to a row of lights on an airstrip that pointed toward the volcano. "I figured that as long as I could see the lights, the pyroclastic flow hadn't reached us. If the lights went out, I had maybe twenty seconds to run to the back of the building. Maybe that would be enough protection."

69 Then the air and sky seemed to lighten, just a shade. The pyroclastic flow hadn't reached the base. Andy and his friends checked the instruments. Everything was flatlining—all the monitoring stations had been destroyed—except for one. A station on the base.

victim If you fall victim to something, you suffer or die because of it.

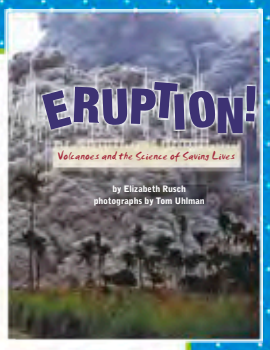
70 The volcanologists quickly grabbed what they could, piled into trucks, and tore off. That is, until they merged with hordes of evacuating Filipinos. "It was a huge, slow-moving traffic jam of everybody with a water buffalo strolling out of town," says Andy. "We were going crazy with the delay, but at least we were headed away from the volcano."

71 But Andy, the other volcanologists, and the villagers managed to escape with their lives.

72 The eruption of Mount Pinatubo was the second largest eruption in the twentieth century. A few hundred people died, most in buildings that later collapsed under the weight of rain-soaked ash. But more than 20,000 lives were saved. "We got it right," Andy said. "We questioned ourselves and doubted ourselves as things unfolded, but we got it right."

This ash-covered news box on Clark Air Base tells the story of the headline.

Respond to the Text



Collaborative Discussion

Look back at what you wrote on page 182. Tell a partner two things you learned from the text. Then work with a group to discuss the questions below. Support your answers with facts and details from *Eruption!* During the discussion, explain how your ideas connect to those of others in your group.

1. Review pages 186–194. Does the author include in the text? What do those quotes help you understand?

2. Reread page 188. What additional information does the sidebar "Looking for Lumps" provide? Why does the author present it separately from the main text?

3. What details explain why the decision to evacuate was difficult to make?

Listening Tip

Listen to the ideas and details each speaker shares. What new information can you add?

Speaking Tip

Think about how other speakers' ideas are related to your own. Ask questions to be sure you understand their comments.

Cite Text Evidence

Write a News Report

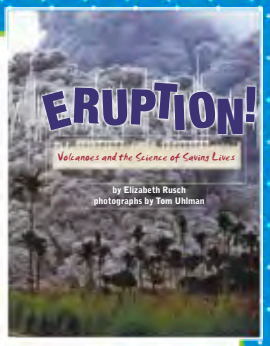
PROMPT

In *Eruption!*, you learned how scientists closely monitored Mount Pinatubo during its eruption. They knew that their observations could help save lives.

Imagine you've been assigned to cover this story for an online newspaper. The date is June 14. Write a news report telling what is happening to the volcano, in the correct sequence. Ask *who, what, when, where, why,* and *how* to gather information from the text to be sure you've recorded all the information readers will want to know. Include a scientific word related to the eruption, and explain the meaning of the word to your readers. Don't forget to use some of the Critical Vocabulary words in your writing.

PLAN

Make notes from the text about the eruption events that happened on June 14. Keep track of the order of events and include a scientific word and its meaning.



WRITE

Now write your news report about the eruption of Mount Pinatubo.

Make sure your news report

- ☐ introduces the topic.
- ☐ uses evidence from the text.
- ☐ tells about the events in order.
- ☐ includes a scientific word and its explanation.

myNotes

Prepare to View

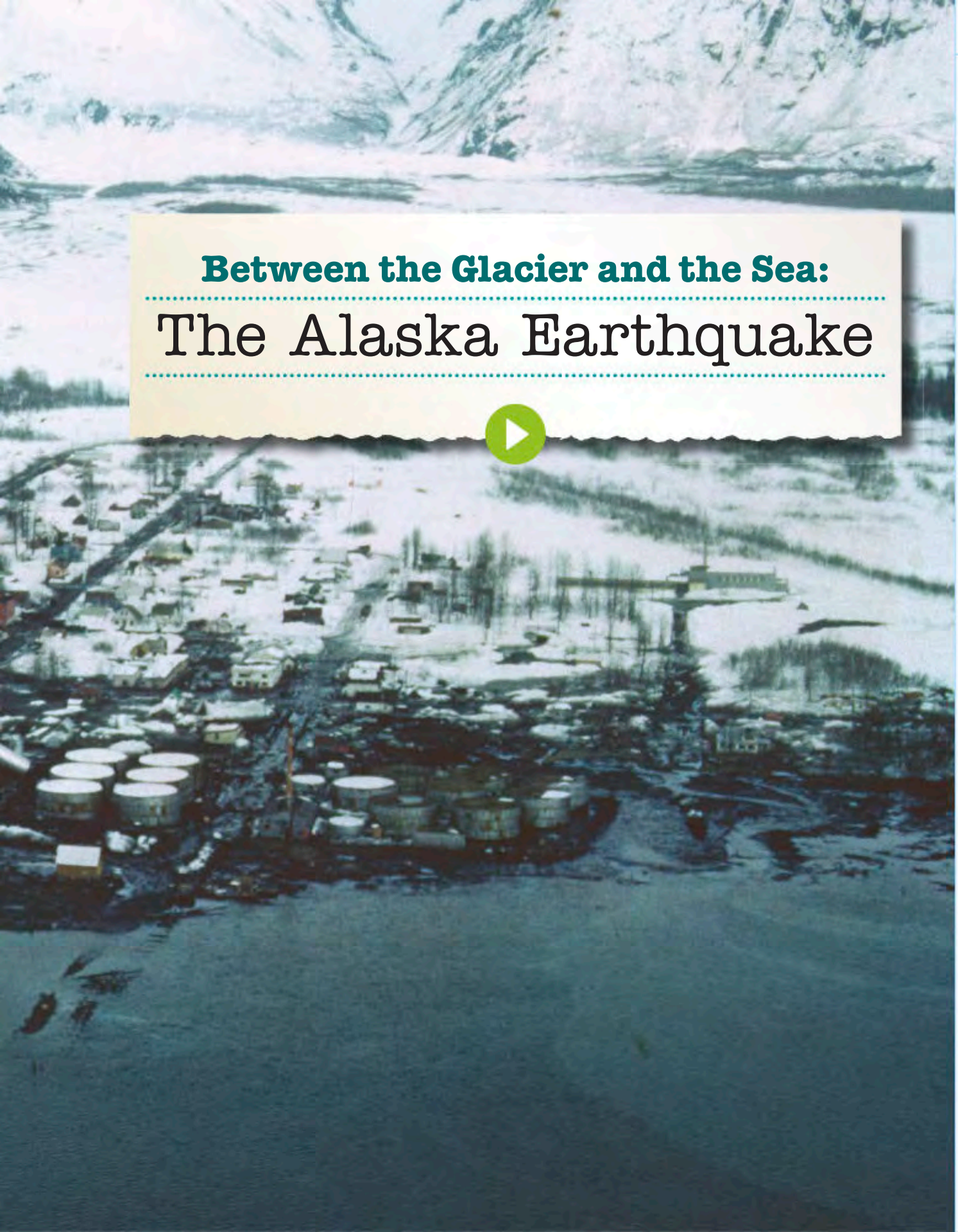
GENRE STUDY **Informational videos** present information about a topic, person, or event in visual and audio form.

- A narrator explains what is happening on the screen.
- Experts may be interviewed to help explain key points.
- Words that are specific to science or social studies topics may be included.
- First-person accounts are sometimes featured to help viewers better understand an event or experience.

SET A PURPOSE **As you watch**, think about the kinds of events that occur during and after a large earthquake. What do you already know? What do you want to learn? Write your ideas below.

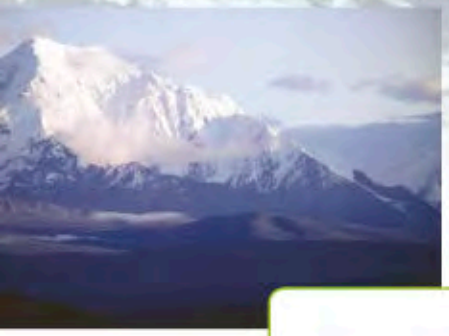
CRITICAL VOCABULARY

- prior
- magnitude
- literally
- maintenance



Between the Glacier and the Sea:

The Alaska Earthquake



As you watch *Between the Glacier and the Sea: The Alaska Earthquake*, think about how the video uses sound and visual elements to explain events and experiences. How do the narration and the animations work together to clarify why the earthquake happened? Do the earthquake survivors' descriptions make the video stronger? Why or why not? Take notes in the space below.

Listen for the Critical Vocabulary words *prior*, *magnitude*, *literally*, and *maintenance,* and for clues to the meaning of each word. Take notes in the space below about how the words are used in the video.

prior Prior means coming before, in time or order.

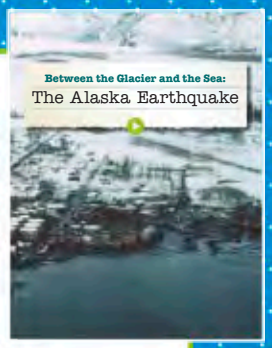
magnitude Magnitude refers to the size of something.

literally If you say something literally happened, that means it actually happened, and you aren't exaggerating or using a metaphor.

maintenance The maintenance of something is the act of caring for it and repairing it when needed.

Respond to the Text

Collaborative Discussion



Look back at your response on page 198 and talk with a partner about what you learned from the video. Then work with a group to discuss the questions below. Take notes about details and examples in *Between the Glacier and the Sea: The Alaska Earthquake* to support your responses. During the discussion, listen actively to each speaker and build on each other's ideas.

1. What was remarkable about the 1964 Alaska earthquake?

2. Why is hearing the story about the oil fires from one of the survivors important? What impact does it have on you as a viewer?

3. What has the information in the video taught you about the earthquake survivors?

Listening Tip

Watch the facial expressions and gestures each speaker uses to explain his or her thoughts.

Speaking Tip

Use your notes to help you state your ideas clearly.

Cite Text Evidence

Write a Video Promo

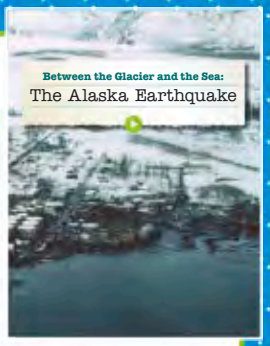
PROMPT

Between the Glacier and the Sea: The Alaska Earthquake uses narration and visuals to help viewers understand the events, experiences, and feelings surrounding the largest earthquake in North American history.

Imagine you're someone who writes content to promote videos. Write a paragraph that summarizes and promotes *Between the Glacier and the Sea: The Alaska Earthquake.* Use key details from the narration and visuals to grab the interest of viewers and encourage them to watch the video. In your summary, emphasize the effects of the strong audio, visual, and narrative techniques on viewers. Don't forget to use some of the Critical Vocabulary words in your writing.

PLAN

Make notes about the key details in the video and the audio, visual, and narrative techniques used to make those details come to life.



WRITE

Now write your video promotion.

Make sure your video promo

- ☐ summarizes the key details from the video.
- ☐ emphasizes the audio, video, and narrative techniques used in the video.
- ☐ is written to grab the interest of viewers.

myNotes

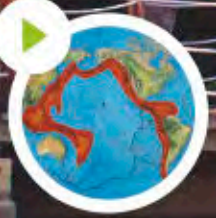
Notice & Note
Numbers and Statistics

Prepare to Read

GENRE STUDY **Informational texts** tell about a topic, event, or place.

- Informational texts may organize ideas under subheadings. They contain main ideas and supporting details, including facts, examples, and sometimes quotations.
- Informational texts may contain science or social studies words specific to the topic.
- Visuals, such as diagrams and maps, and text features, such as sidebars, may tell more about the topic.

SET A PURPOSE **Think about** the title and genre of this text. What do you know about earthquakes and tsunamis? What do you want to learn? Write your ideas below.



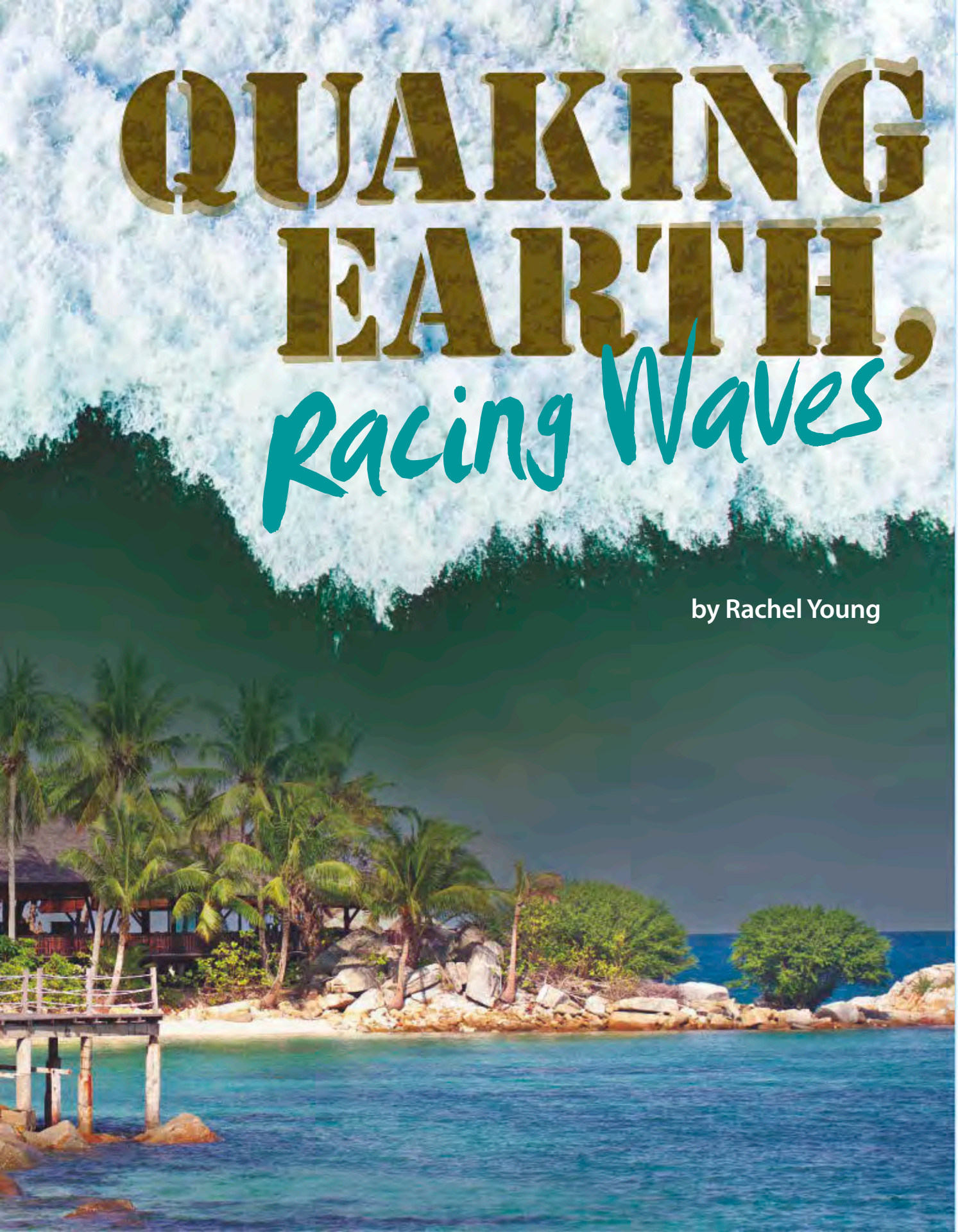
Build Background:
The Pacific Ring of Fire

CRITICAL VOCABULARY

- parallel
- lateral
- destruction
- triggered
- thrust
- radiate
- modified

QUAKING EARTH, Racing Waves

by Rachel Young



myNotes

1 In July 2004 the village school on Tello Island, Indonesia, had a visitor with a startling story to tell. As the students in their red-and-white uniforms sat quietly listening, geologist Kerry Sieh explained that under the ocean, 60 miles from their island, was a ticking time bomb.

2 For hundreds of years, the Sunda Megathrust Fault had been storing energy that would be released in massive undersea earthquakes. The powerful quakes would likely cause tsunamis, fast-moving waves that could wipe out the entire seaside village.

3 The students and their teachers were surprised by Sieh's warnings. They'd never felt giant earthquakes or seen tsunami waves. How did he know that the earth was going to shake?

4 Sieh explained that, for more than a decade, scientists from the California Institute of Technology had been studying a section of the fault just to the south. They'd figured out that major earthquakes shook the region about every 200 years. The last big quake was in the early 1800s, which meant another could come at any time. Though Sieh couldn't say exactly when it would happen, he was almost certain there would be at least one major earthquake in the students' lifetimes.

5 But no one could have known that the next big quake would hit just a few months later.

RISING CORALS

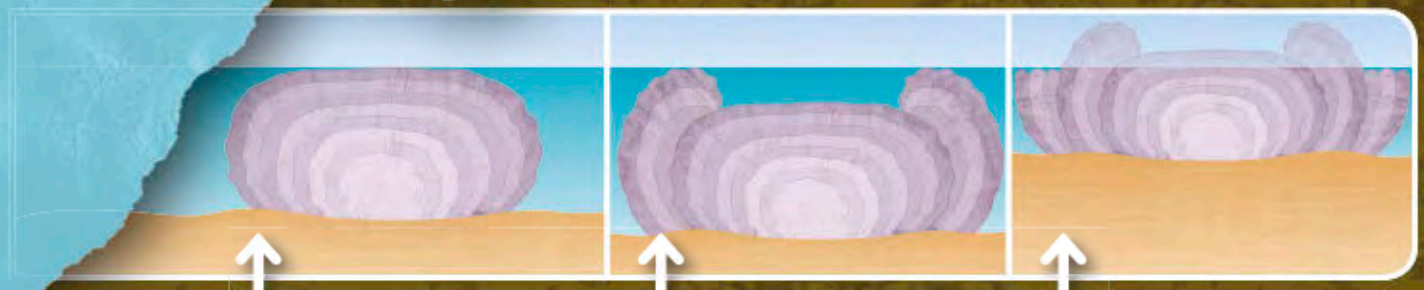
6 Scientists know a lot about earthquakes after they happen, but they can't predict what hour, day, year, or even decade an earthquake will hit. So how did Kerry Sieh know to warn the Tello islanders that an earthquake might happen soon? He read the corals.

Porites coral

7 In the Indian Ocean, big corals called *Porites* grow from the sea floor to the water's surface, then outward. The ocean floor sinks slowly between

earthquakes, dragging the coral down, then rises quickly during a quake, raising the coral up again. Over hundreds of years, all this up and down causes the coral to grow outward in doughnut-shaped rings. Sieh discovered that by looking at the growth patterns of *Porites* coral heads near the fault, he could pinpoint the dates of past earthquakes, and maybe find a pattern that would help predict future quakes.

8 Using underwater chainsaws, Sieh and other scientists sliced off slabs of coral heads that were hundreds of years old. Sure enough, they found that, on a section of the fault just to the north of the Mentawai Islands and just to the south of Tello, earthquakes occurred in pairs about every 200 years. One pair of quakes hit in the 1300s, another in the 1500s, and a third in 1797 and 1833—almost 200 years ago. According to the corals, it was time for another big quake.



When it reaches the ocean's surface, a coral head stops growing upward. Only the sides, which are still underwater, continue to grow outward in rings, like the growth rings of a tree. You can tell how old a coral is by counting the rings.

Between earthquakes, the ocean floor is slowly sinking. And the coral, which is attached to the ocean floor, is sinking, too. The coral head drops below the water line, and the sides grow up to the water's surface.

During an earthquake, part of the ocean floor springs up, and some coral heads are lifted half out of the water. The section of coral above the sea dies, while the part still under the sea keeps growing. From above, the coral looks like a little doughnut inside a series of bigger ones.

myNotes

SINKING ISLANDS

9 The corals weren't the only evidence of underground rumblings in Indonesia. The Sunda Megathrust Fault at the bottom of the Indian Ocean marks the collision between two of the plates that make up the earth's surface, one oceanic, the other continental. Between earthquakes, the plates are stuck together. As the oceanic plate slips slowly downward, it squeezes the continental plate sideways about half an inch a year, and drags it down a few inches a year as well. The islands on top of the continental plate are dragged down too, as much as half an inch a year. The more years between earthquakes, the more the islands sink—and the more stress builds up at the fault.

10 The islanders could tell that the water line was shifting. "They can see their boardwalks and harbors sinking," Sieh said. Trees that once grew tall on shore were now underwater, and wells that once gave freshwater were full of salty seawater instead. But no one thought that this had anything to do with earthquakes or tsunamis.

11 Evidence from Global Positioning System, or GPS, stations they'd set up to measure island sinking also had convinced the scientists that a big quake could rock the area at any time. "As we came to realize what we were learning, and how much at risk people were," said Sieh, "we couldn't keep quiet."

12 In July 2004, Sieh visited five islands and gave presentations at schools, churches, mosques, and village squares. Sieh and his colleagues planned to return the following year to visit more islands and teach more people about their research. Then, six months later, a quake struck.

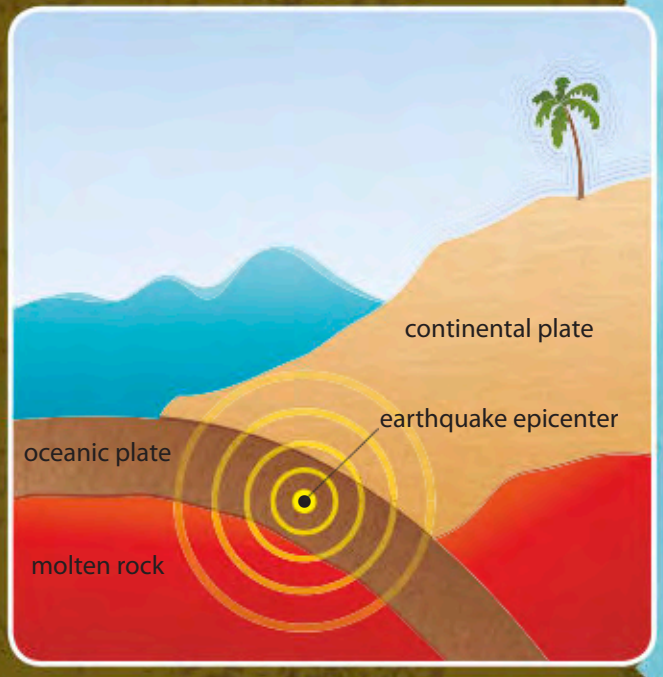
A geographer prepares a GPS station in Indonesia to collect data.

What Makes the Earth Quake?

Next time you're outside, jump up and down. Stomp your feet a few times. The ground seems solid, right? Well, not entirely.

The part of the earth you're standing on, called the lithosphere, is rock-solid. But the lithosphere is very thin—if the earth were the size of an apple, the lithosphere would be about as thick as the apple's skin. If you dug a hole through the earth, you'd find that as you went deeper, what's inside becomes hotter and more gooey. The solid lithosphere is broken up into close-fitting plates that drift on top of the molten rock underneath. We don't feel the plates moving because they're usually drifting only a few centimeters a year—about as fast (or slow) as your fingernails grow.

Earth's plates don't all move parallel to each other and in the same direction. At the boundary where two plates meet, called a fault, they bump and push into each other. They're wedged together most of the time, but stress builds up as the plates bump and grind together. Finally the plates break free along a section of the fault, releasing pent-up energy in an earthquake. The force makes objects move up and down and in a lateral motion, and it can cause great destruction.



There are several different types of faults. The Sunda Fault offshore from the Batu and Mentawai islands is called a megathrust, where the underwater oceanic plate dives under the continental plate.

parallel If two or more things are parallel to each other, they move in the same direction.
lateral If something moves in a lateral way, it moves side to side.
destruction Destruction is the act of destroying or ruining something.

myNotes

DECEMBER 26, 2004

13 The ground shook so violently that people were knocked off their feet. Dishes fell from shelves, roofs collapsed, trees toppled. Two minutes after it began, the shaking stopped. It had been the biggest earthquake anywhere on the planet in 40 years.

14 Like a twig you bend and bend until it breaks, pressure that had been building along the Sunda Megathrust Fault for hundreds of years had finally given way. Along a section of the fault longer than the state of California, the oceanic and the continental plates suddenly, violently separated, which triggered earth-shaking waves. But the worst was still to come.

No Ordinary Waves

Most waves are formed by wind that blows across the ocean's surface, pulling water with it. But a tsunami is started by a disturbance, such as an undersea earthquake, that shifts water at the ocean floor. Water is thrust up from the bottom of the sea all the way to the ocean's surface, and waves begin to radiate out in all directions. As a tsunami wave hits the shallow water near land, it slows down but grows taller. Water at the shore is sucked into the giant wave, exposing fish, shells, and corals that were underwater moments ago. Then, suddenly, a towering wall of water crashes onto the beach.

triggered If you triggered an action or event, you did something to start it.
thrust To thrust is to push something with great force.
radiate To radiate is to spread out in waves or rays.

15 The continental plate sprang up as much as 20 feet, pushing up the water above it. Tsunami waves rippled out in all directions, gaining power as they raced across the open ocean as fast as jet airplanes. The first wave, 100 feet tall in some places, hit the Indonesian island of Sumatra 15 minutes after the earthquake. Waves swamped the coast of Thailand 75 minutes later, then India and Sri Lanka, and even Africa, 3,000 miles from the quake's center.

16 The deadly waves kept flooding beaches for hours. Hundreds of thousands of people were killed, and millions were left homeless.

17 Kerry Sieh was at home in California when he heard the news. Immediately, Sieh thought of his friends on the islands he'd visited. Had they escaped the quaking ground and giant waves? Had their homes and villages been destroyed? Communication by phone or email was impossible. On January 1, he flew back to Indonesia, uncertain of what he'd find.

SAFE FOR NOW

18 People in Tello were lucky. Their island was more than 200 miles from the epicenter of the quake, the most powerful point. On Tello during the quake, the earth shook, but not violently. Later, a small tsunami, three to six feet high, swept through the village, flooding houses. People were shaken and scared, but unharmed.

19 As he traveled to the other islands he'd visited in July, Sieh was relieved to hear the same story. Few homes had been destroyed, and no lives were lost. But danger still lurked. An earthquake on one section of a fault can increase stress along the rest of the fault. And the thousands of miles of the Sunda Megathrust Fault that hadn't ruptured in December were still ripe for another quake.

20 Sure enough, another earthquake shook an area to the south on March 28. This quake was 10 times less powerful than the one in December, yet it was still the second-biggest quake to rock the world in 40 years.

21 Again, Sieh's friends escaped harm. But the quakes were proof that what the scientists had said was true, and they convinced some islanders to take action. Today, on the island of Simuk, many people have left

Destruction after the 2004 earthquake and tsunami in Indonesia

their homes near the shore and have rebuilt their town at the island's highest point, the hill where Sieh erected his GPS station. Their modified town is better prepared for tsunamis.

22 The quakes also provided Sieh with a lot of work to do. On Sumatra, the rising continental plate pushed up vast stretches of beach that had been underwater. "We saw thousands of dead corals," Sieh said. He looked at data from the GPS stations to find out exactly how the nearby islands moved during the quakes.

modified A modified version of something is a revised, or changed, version.

Destruction after the 2004 earthquake and tsunami in Indonesia

myNotes

23 As they traveled the islands by boat and helicopter, Sieh and his colleagues explained why earthquakes and tsunamis happen and what people can do to prepare. They can build their houses out of lightweight wood or bamboo rather than heavy concrete, which would cause more damage if it toppled during a quake. They can move their villages away from the beach, or build pathways to higher ground.

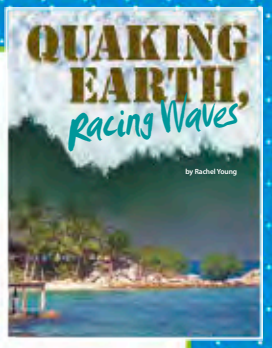
24 Sieh doesn't know exactly when or where it will hit, but he's certain another big quake is coming along the section of the fault south of Tello. Until it does, he'll try to understand as much as he can about why and how the earth moves, and he'll teach the people who live nearby about the danger that lurks under the waves.

Students cover their heads during an earthquake drill in Indonesia.

An official talks to students during an earthquake and tsunami drill in Indonesia.

Respond to the Text

Collaborative Discussion



Look back at what you wrote on page 204. Tell a partner two things you learned during reading. Then work with a group to discuss the questions below. Include details from *Quaking Earth, Racing Waves* to support your answers. Be sure to follow your class's rules for an orderly discussion.

1. Revisit pages 206–207 of the selection. What did Sieh and the other scientists learn from "reading the corals"?

2. Reread page 209. What causes an earthquake? Why isn't it possible for us to feel the usual plate movements that take place on the Earth's surface?

3. What is the difference between a tsunami and a normal ocean wave?

Listening Tip

Listen politely to ideas that speakers share. If you are the recorder for your group, jot down key points.

Speaking Tip

Let your group's leader know when you want to speak. Then share your answer with a clear voice that others can hear.

Cite Text Evidence

Write a Presentation

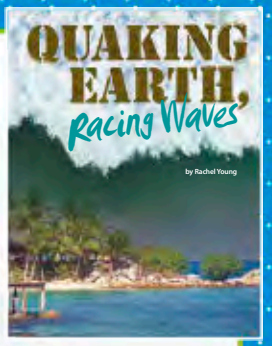
PROMPT

In *Quaking Earth, Racing Waves,* you read about a scientist who predicted an earthquake based on evidence he had observed. He and other scientists also gave presentations to people who lived in the danger zone. They told the people why earthquakes and tsunamis happen and what can be done to prepare.

Imagine that you are a scientist and must write a presentation explaining why earthquakes and tsunamis happen. Begin with an opening sentence that introduces your listeners to your topic. Use your understanding of the key information in the text to focus and support your central ideas. Don't forget to use some of the Critical Vocabulary words in your writing.

PLAN

Take notes from the text about what causes earthquakes and tsunamis. Include important details that support the central ideas.



WRITE

Now write your presentation to help people understand why earthquakes and tsunamis happen.

Make sure your presentation

- ☐ introduces the topic and explains who you are.
- ☐ uses evidence from the text to focus your central ideas.
- ☐ uses details from the text to support your central ideas.
- ☐ concludes by inviting the audience to ask questions.

myNotes

Notice & Note
Numbers and Statistics

Prepare to Read

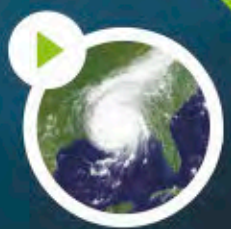
GENRE STUDY **Informational texts** give facts and examples about a topic.

- Informational texts are often organized using headings that help readers identify main ideas.
- Science texts include words that are specific to the topic.
- Informational texts often include visuals, such as charts and maps, and sidebar features, which tell more about the topic.

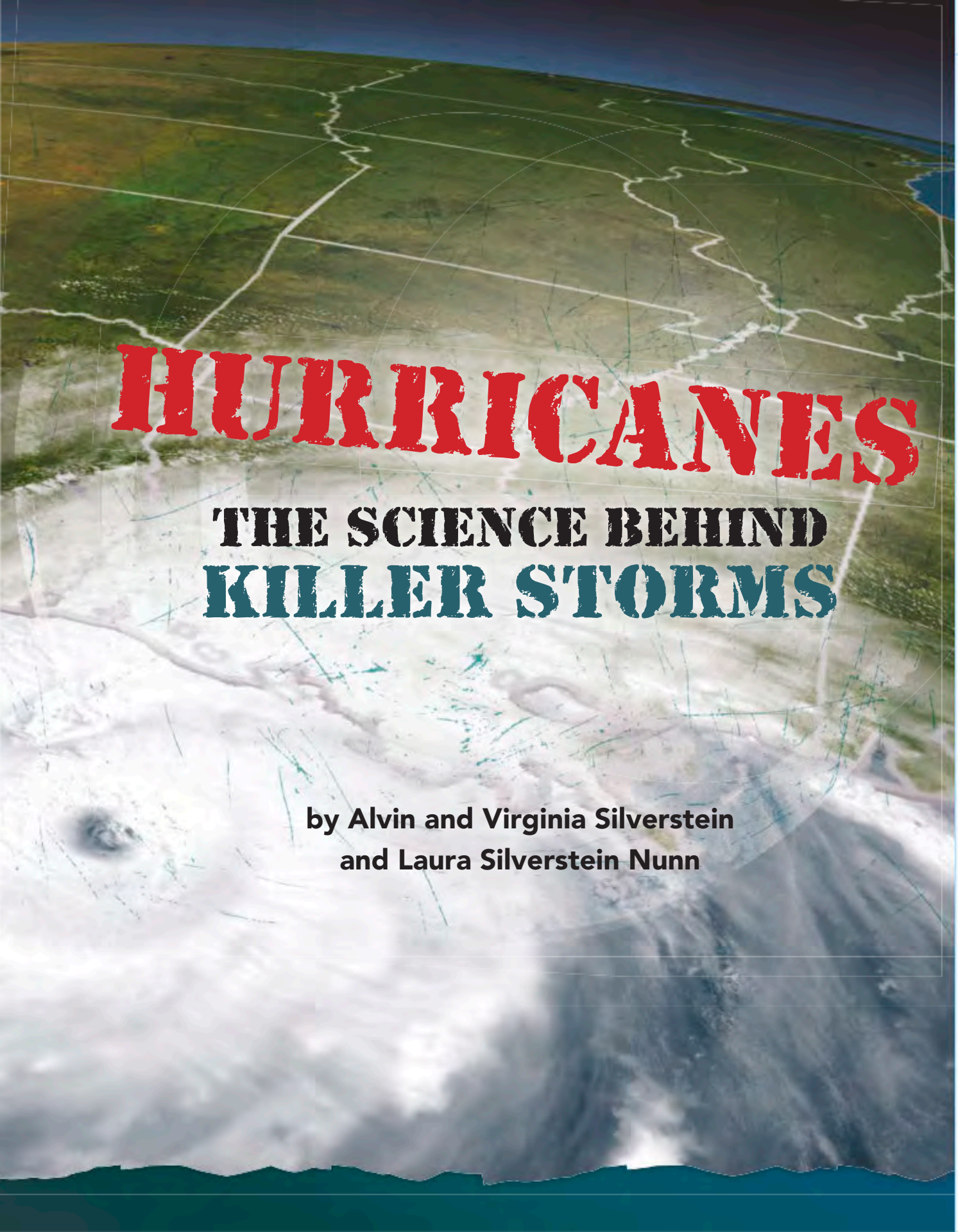
SET A PURPOSE **Think about** the title and genre of this text. What do you know about hurricanes? What do you want to learn? Write your ideas below.

CRITICAL VOCABULARY

- surge
- eventually
- regions
- mobile
- anchored
- foundations
- category
- track



Meet the Authors:
Alvin and Virginia Silverstein and Laura Silverstein Nunn



HURRICANES

THE SCIENCE BEHIND KILLER STORMS

by Alvin and Virginia Silverstein
and Laura Silverstein Nunn

1 **YOU WILL NOT HEAR ABOUT HURRICANE DISASTERS** in Kansas or the Sahara Desert. Hurricanes not only need heat to form, but they also need moisture—lots of it. The warm ocean waters of the tropics are perfect for the birth of a hurricane.

2 Meteorologists (weather scientists) use the term tropical cyclone to describe any storm over the tropical oceans that spins in a circle around a center of low pressure. Tropical cyclones are known by different names, depending on where they form. If these storms develop in the North Atlantic Ocean, the northeastern Pacific Ocean, the Gulf of Mexico, or the Caribbean Sea, they are called hurricanes.

3 In the northwestern Pacific Ocean, near Japan and the Philippines, hurricanes are known as typhoons. Near Australia and in the Indian Ocean, they are called cyclones.

A Hurricane's Life Cycle

4 A hurricane goes through a series of four stages as it grows: tropical disturbance, tropical depression, tropical storm, and hurricane. Not all storms reach the higher stages.

5 **Tropical disturbance:** Tropical disturbances form over warm, tropical oceans, with water surface temperatures at least 80 degrees Fahrenheit. The warm surface water evaporates, sending water vapor into the air. As the moist air rises, it cools. Some of the water vapor condenses into water droplets, forming clouds. Clouds pile up high into the atmosphere, and thunderstorms develop.

6 **Tropical depression:** As the warm, moist air above the ocean rises, it creates an area of low air pressure. Cool heavier air from the surrounding area sinks, replacing the rising air. A cluster of thunderstorms joins to form a single large weather system. Soon a whirlpool of hot, moist air is spiraling around a low-pressure center. As the swirling winds turn, they gather more energy from the warm water below. The wind speed rises. If the winds reach 38 miles per hour, the growing storm is ready to enter the next stage.

High waves crashed ashore in Shizuoka, Japan, on September 6, 2007, as Typhoon Fitow advanced toward Japan's main island of Honshu. These waves were part of Fitow's storm surge.

What Does "Hurricane" Mean?

The term *hurricane* comes from "Huracan," the god of evil, named by an ancient Central American Indian group. Spanish colonists later changed the spelling to "hurricane."

surge A surge is a sudden powerful movement forward or upward.

myNotes

7 **Tropical storm:** The storm continues to grow stronger, and the winds blow faster. The strong winds draw up more heat and water vapor from the ocean surface, feeding the storm. Some of the water vapor condenses, producing heavy rain. Thunderstorms release heat, giving the storm even more power. Viewed from an airplane flying above the storm, the clouds have a distinct circular shape. If the wind speed reaches 74 miles per hour, the storm has reached the last stage—a hurricane.

8 **Hurricane:** The swirling winds of a hurricane surround the eye—an area of warm low-pressure air at the center. This is a calm area that may be from 6 to 40 miles across.

9 In the eye of the storm it may be sunny with only light winds. To someone on the ground, it seems like the storm is over. But it is not.

10 The strongest winds blow around the edge of the eye, called the eyewall. Bands of thick clouds, called rainbands, swirl outward around the eyewall. As the storm moves, the area that was below the eye suddenly gets stormy again. The rainbands can produce more than 2 inches of rain per hour.

11 As it develops, a hurricane moves across the ocean. It usually travels northwest at a speed of 10 to 20 miles per hour. It may eventually reach a coast and move inland. As soon as the hurricane passes over land, however, its wind speed drops. Remember that the warm ocean waters supply a hurricane with energy. The air over land areas is cooler and drier, so the hurricane gets weaker. Soon it may become just a tropical storm, and eventually it dies out.

12 Sometimes a hurricane may change course and move back out over the ocean. Picking up energy, it may later hit the coast again in a different spot with greater force. This is what happened with Katrina, which first hit Florida, then moved over the Gulf of Mexico to hit the Gulf Coast even harder. A hurricane can last an average of three to fourteen days, and travel as many as 4,000 miles.

eventually To state that something will happen eventually means that it will happen at some time, usually after a series of other events.

Why Do Hurricanes Swirl Around in a Circle?

Winds start blowing in a straight direction. But they curve because the Earth moves as it spins on its axis. This is known as Coriolis effect. The faster the winds blow, the more they curve. In a hurricane, winds blow so fast, they form spirals. In the Northern Hemisphere, the winds in a hurricane blow counterclockwise. In the Southern Hemisphere, they move clockwise.

Where Do Hurricanes Start?

The winds that blow over the tropical oceans are typically "easterlies"—winds that blow from east to west. Thunderstorms that develop in low-pressure areas disturb this wind flow, producing a wavelike movement. Meteorologists call it an easterly wave, or a tropical wave. About 80 percent of hurricanes in the Atlantic Ocean start in easterly waves over western Africa.

The shaded areas show where hurricanes form. The arrows represent paths that they often take. The lighter the color of the ocean, the higher the sea-surface temperature.

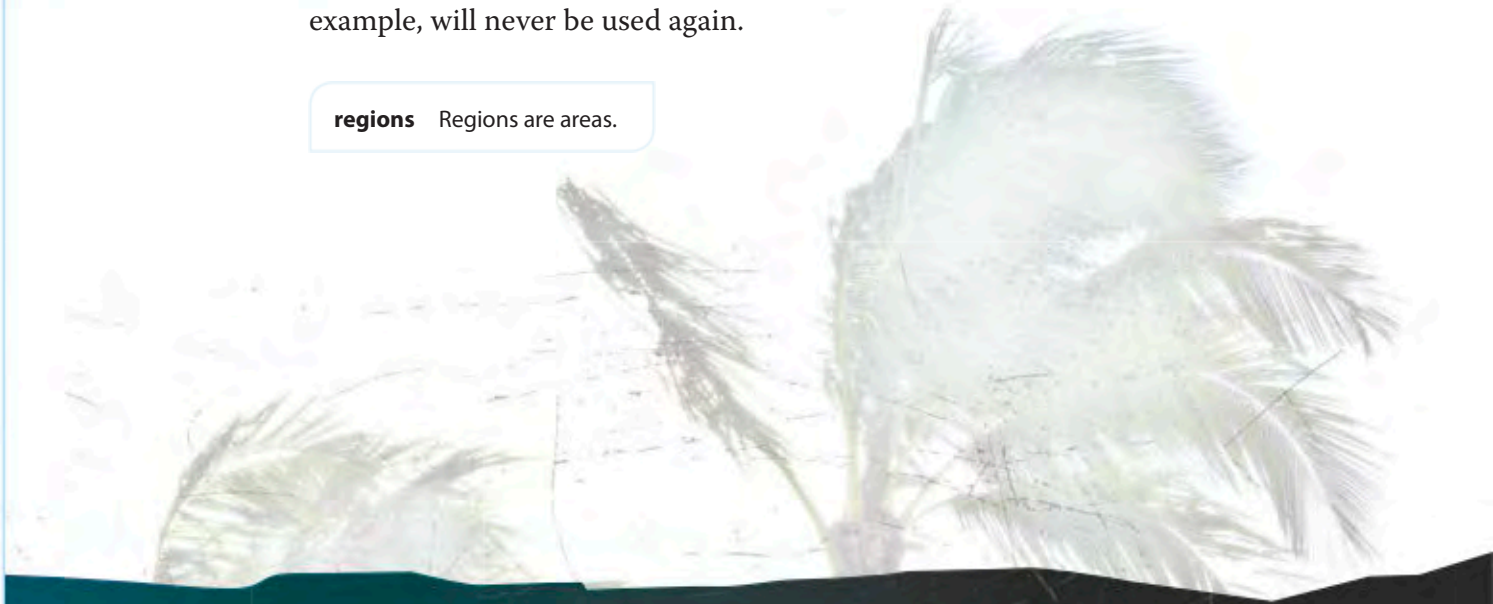
myNotes

Naming Hurricanes

13 Every year, meteorologists use a special alphabetical list of names for hurricanes. Different lists are used for hurricanes in the Atlantic and Pacific regions. The names are common first names in the languages of the regions where the storms strike.

14 Hurricane names are retired (no longer used) if a named storm causes a tremendous amount of damage or the loss of many lives. "Katrina," for example, will never be used again.

regions Regions are areas.



Are Big Hurricanes More Powerful Than Small Ones?

Not always. Hurricane Andrew, which hit southern Florida in 1992, was the second-most destructive hurricane in U.S. history. But it was fairly small, measuring only 60 miles across, compared to the average hurricane, which covers an area 300 miles wide.

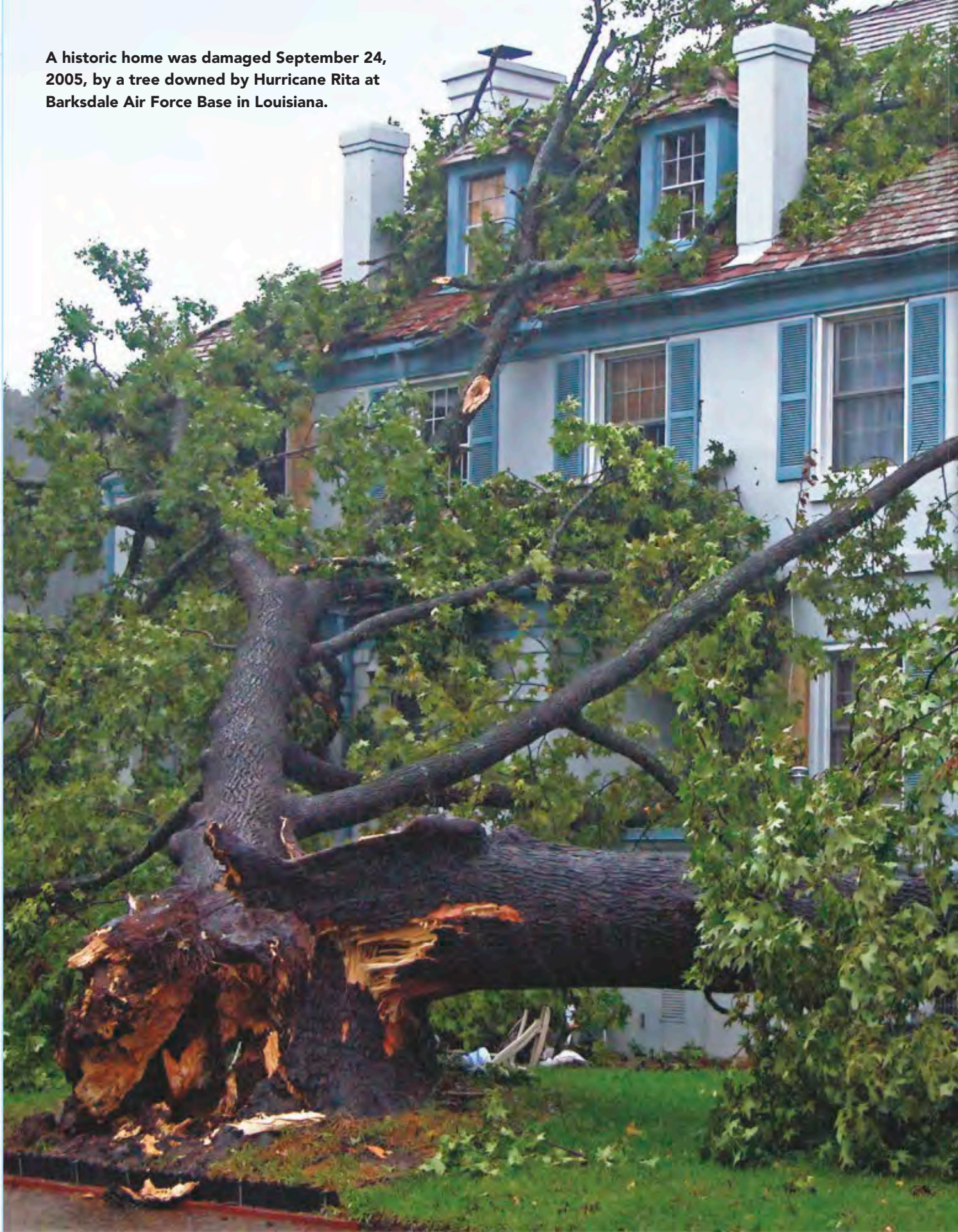
When Is Hurricane Season?

Hurricanes usually form at a certain time of the year, known as the hurricane season. Since hurricanes need warm, moist air to form, they usually develop during the summer and autumn months. The Atlantic hurricane season is from June 1 to November 30. The hurricane season for the northeast Pacific is May 15 to November 30.

This satellite image of Hurricane Katrina shows the storm centered over Louisiana on August 29, 2005.

This towering mass of white clouds is part of Hurricane Katrina's eyewall, the area around the central eye. The strongest winds are found in the eyewall. The picture was taken on August 28, 2005, from a hurricane-hunter airplane.

myNotes



A historic home was damaged September 24, 2005, by a tree downed by Hurricane Rita at Barksdale Air Force Base in Louisiana.

WHEN A HURRICANE HITS

15 **EVERY YEAR, EIGHTY TO ONE HUNDRED** tropical storms develop around the world. About forty to sixty of them get strong enough to become hurricanes, typhoons, or cyclones. And only a few of those ever reach places where people live.

16 More hurricanes hit some regions than others. In the northwest Pacific Ocean, for example, an average of twenty-eight tropical storms occur each year; nineteen of them become typhoons. In the Atlantic Ocean, however, an average of only ten tropical storms develop every year, and six of them become hurricanes. Over a three-year period, the United States coast gets hit an average of five times by hurricanes, and two of them are major hurricanes. When a hurricane hits land—no matter where—the effects can be disastrous.

Whipping Winds

17 Hurricane winds are extremely powerful. Out at sea, the winds can blow up to 200 miles per hour. Although a hurricane loses energy when it moves over land, the winds still cause a lot of damage. Strong gusts of wind rip huge trees out of the ground. They toss cars and people through the air. The wind can even turn small objects, such as a road sign or a lawn chair, into deadly flying missiles.

18 Hurricanes are especially destructive when they hit an area where many people live. Hurricane Andrew, for example, had winds of 165 miles per hour when it reached the coast of southern Florida in 1992. It passed through an area south of Miami that was filled with homes and businesses. Many of the buildings there were mobile homes, which do not weigh as much as houses. They also are not well anchored to the ground. In some communities, more than 90 percent of mobile homes were completely destroyed.

mobile Something that is mobile is able to move or be moved easily.

anchored Something that is anchored is firmly attached to something else or weighed down so it won't move easily.

myNotes

In August 1992, Hurricane Andrew caused massive destruction in southern Florida. Hundreds of thousands of homes and businesses were damaged or destroyed.

Storm Surges

19 Even though a hurricane's winds are dangerous, people are more likely to die from a storm surge. The winds of the storm push ocean waters toward the shore, forming a huge wave. The low air pressure also lifts the water, raising the level even higher. These forces combine with the normal ocean tides, forming a huge wall of water. Many hurricanes have produced storm surges more than 20 feet high.

20 The surging water smashes into buildings and washes out roads. The storm surge may also wash away beaches and remove the soil around the foundations of houses.

foundations Foundations are the base pieces houses and buildings are built upon.

It's a Fact!

Hurricane Camille, which hit the Mississippi and Alabama coasts in August 1969, had the most powerful hurricane winds over land in United States history. They blew more than 190 miles per hour.

Heavy Rains

21 Hurricanes can cause serious flooding even without a storm surge. Their rainbands can dump 10 to 15 inches of rain in a twenty-four hour period. Bigger storms bring heavier rains—up to 20 inches or more. Such huge amounts of rainfall in a short amount of time can flood entire communities.

22 Heavy rains can also cause mudslides. Rain mixes with the soil on mountains and hillsides and forms mud. The mud flows downhill. Rocks break free, adding to the mixture. As the mudslide rushes down the mountain, it rips out trees and carries away houses. Down below, it buries everything in mud. Hurricane Mitch killed more than ten thousand people in 1998 due to mudslides caused by heavy rains.

When Hurricane Floyd came toward land in September 1999, its storm surge collapsed this pier at Daytona Beach, Florida.

myNotes

Tornadoes

23 Hurricanes can also bring tornadoes. These are small but very powerful storms. The winds of a tornado, or "twister," rapidly swirl around in a tall cloud that is funnel-shaped. Some hurricanes do not produce any tornadoes; others spawn, or form, many of them. Hurricane Katrina, for example, produced sixty-two tornadoes. The tornadoes that come with hurricanes are not usually as powerful as those that form during thunderstorms in the Midwestern states.

What's the Damage?

24 Scientists use the Saffir-Simpson Hurricane Scale to rank the strength of the hurricane. The scale rates a hurricane from Category 1 (least powerful) to Category 5 (most destructive). The rating is based on average wind speed. Each category also indicates the level of storm surge and how much damage scientists think the hurricane will do.

25 Hurricanes in categories 3, 4, and 5 are considered major hurricanes. They can cause widespread damage to property, severe inland flooding, and significant loss of life. Hurricanes can change categories as they gain or lose strength. That is what happened with Hurricane Katrina. Over the Gulf of Mexico, Katrina had become a Category 5, but it was down to Category 3 by the time it reached the Louisiana-Mississippi border as it moved inland.

category A category is a group of things that are similar to each other in some way.

What Is the Difference Between Hurricanes and Tornadoes?

Hurricanes and tornadoes are both cyclones—powerful windstorms that spin in a circle. But they have major differences:

- Hurricanes form over the ocean. Most tornadoes form over land.
- Hurricanes are huge, often hundreds of miles wide. Tornadoes are usually much smaller, only 4,000 to 5,000 feet wide.
- Hurricanes last for up to two weeks. Tornadoes last for up to three hours.
- Hurricane winds are not as powerful as tornado winds. Tornado winds typically blow 200 to 300 miles per hour.

Are Hurricanes Getting Worse?

26 Some studies have shown that the number of category 4 and 5 hurricanes has increased worldwide since the 1980s. Many scientists believe this increase in severe storms is due to global-warming. They think our planet has been getting warmer. Since a warmer planet means warmer oceans, storms have become more powerful. Other scientists have a different idea as to why strong hurricanes have been recorded. They think that scientists have just gotten better at detecting and tracking hurricanes. Because technology has become so advanced, scientists can track hurricanes better and warn people in advance.

track To track something is to watch it and see where it moves and how it changes.

Saffir-Simpson Hurricane Scale

CATEGORY	WIND SPEED	STORM SURGE	DAMAGES
1	74–95 mph	4–5 ft	• Some flooding • Little or no damage to building structures
2	96–110 mph	6–8 ft	• Flooding of coastal roads • Some trees blown down • Damage to roof shingles, doors, and windows
3	111–130 mph	9–12 ft	• Damage to house structures • Mobile homes destroyed • Severe flooding
4	131–155 mph	13–18 ft	• Severe flooding inland • Some roofs ripped off • Major structural damage to lower floors of buildings
5	>155 mph	>18 ft	• Severe flooding farther inland • All trees and shrubs blown down • Mobile homes destroyed • Serious damage to building and house structures

myNotes

Jason Ross, top, and John Heilig, bottom, board up a beach house on September 16, 2003, in Nags Head, North Carolina, as people prepare for a possible hit from Hurricane Isabel.

What Should You Do About Your Pets?

Try to take your pets and pet supplies with you if you have to evacuate pets. They likely will die if left on their own. Come up with a plan for them before there is an emergency.

Hurricane shelters usually will not take in pets. Look for hotels outside your local area that will accept pets. Make a list of animal boarders and veterinary offices that will keep animals in an emergency. Your pets should all have collars and identification tags.

STAYING SAFE

27 **AN ESTIMATED 35 MILLION PEOPLE,** or 12 percent of the people in the United States, live in the southern coastal regions most threatened by Atlantic hurricanes. As the coastal population continues to grow, the damages due to hurricanes also increase.

28 Scientists may not be able to prevent a hurricane from invading where people live. However, there are a number of things people can do to survive when a hurricane hits.

Emergency Plan

29 In case a hurricane hits, you and your family should have an emergency plan. There are probably special hurricane shelters nearby. Find out where they are and the fastest way to get to them.

30 At home, keep a disaster supply kit handy. You will need items to keep you safe in case the power goes out or your neighborhood is flooded. Emergency supplies can get you through a few days stuck in your home or a shelter until regular services are working again. The kit should include:

- Flashlight and batteries
- Battery-operated radio
- First aid kit
- Emergency food and water
- Special items for babies, the elderly, and pets
- Protective clothing, such as rain gear
- Blankets

31 Listen for hurricane warnings on the radio or TV, and follow the instructions. The National Hurricane Center also posts hurricane warnings on its Web site. If the local officials say you should evacuate, leave as quickly as you can.

myNotes

If a Hurricane Is Coming

32 If a hurricane warning is issued for your area, damage to you and your home can be reduced if your family does the following:

- Nail boards over your home's windows.
- Pick up toys, bikes, and other objects outside the house. Put them where they will not blow around and cause damage.
- Prevent flooding by placing sandbags around your house.
- Trim bushes and tree limbs hanging over the house.
- Inside the house, put strips of duct tape crisscross on windows to keep broken glass from flying around.
- Fill bathtubs, pails, and bottles with water for drinking and washing. The water supply may be cut off or polluted.

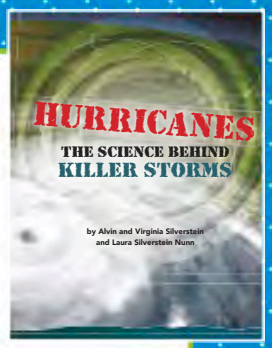
33 Unless there is an evacuation, stay inside your home. Do not leave even if it seems like the storm is over. Remember, it could be the eye of the storm. A hurricane is not over until the second half of the storm has passed.

34 Hurricanes are terrifying disasters, but learning about them can help you be prepared. Knowing where to go and what to do if a hurricane strikes can make a huge difference in keeping you and your family safe.

Vehicles leave New Orleans ahead of Hurricane Katrina on August 28, 2005. Road signs (inset) often inform people of evacuation routes.

Respond to the Text

Collaborative Discussion



Look back at what you wrote on page 218. Talk with a partner about what you learned from the text. Then work with a group to discuss the questions below. Find information in *Hurricanes* to support your answers. Look for ways to connect your ideas to those of others during your discussion.

1. Reread pages 220–222. What conditions need to be present in order for a hurricane to form?

2. Review pages 227–230. What dangerous elements can hurricanes produce? Why is each one a problem?

3. What do the maps and photos in the selection help you understand about hurricanes?

Listening Tip

Listen closely to each speaker's ideas and think about how they are related.

Speaking Tip

Use words and phrases such as *another reason* or *also* to link your ideas to what other speakers say.

Cite Text Evidence

Write a Weather Report

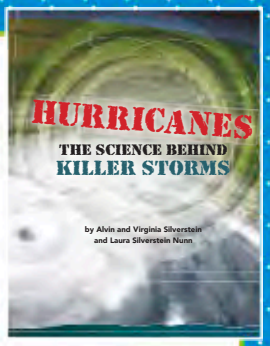
PROMPT

In *Hurricanes*, you learned about how hurricanes form, the types of damage they can cause, and ways people can prepare for these storms. Information such as this is vital for people who live in areas where hurricanes strike.

Imagine that you are a meteorologist for a local TV station, and a Category 2 hurricane is approaching your area. Use evidence from the text to write a weather report telling viewers what kind of effects they can expect the Category 2 storm to cause. Then, explain what viewers should do to stay safe. Be sure to organize the information so that it's easy for viewers to understand. Use a scientific word from the text, and be sure to explain what the word means. Don't forget to use some of the Critical Vocabulary words in your writing.

PLAN

Create two columns of notes, one about expected damage and other effects of the Category 2 hurricane and one about ways to prepare and stay safe. Base your notes on evidence you read in the text.



WRITE

Now write your weather report to inform your viewers about the approaching hurricane.

Make sure your weather report

- ☐ introduces the topic.
- ☐ includes evidence from the text such as the hurricane's strength, possible damage and other effects, and ways to stay safe.
- ☐ uses and explains a scientific word.
- ☐ organizes the information in a way that is easy for the viewers to understand.
- ☐ includes a conclusion.

Performance Task

Essential Question

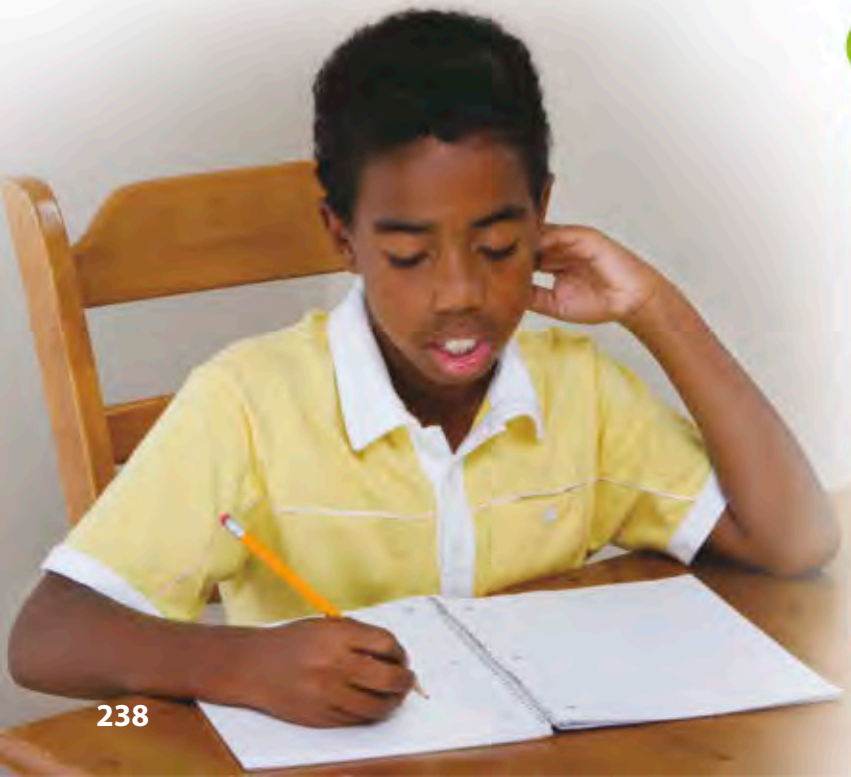
How can learning about natural disasters make us safer?

Write an Editorial

PROMPT Think back on what you learned about staying safe in natural disasters.

Is your school or community ready for a natural disaster? What more could be done to prepare? Choose one natural disaster that you learned about in the module. Write an editorial for your school paper stating what you think needs to be done to ensure the community stays safe. Support your opinion with evidence from the texts and video.

I will write an editorial about _____.



Make sure your editorial

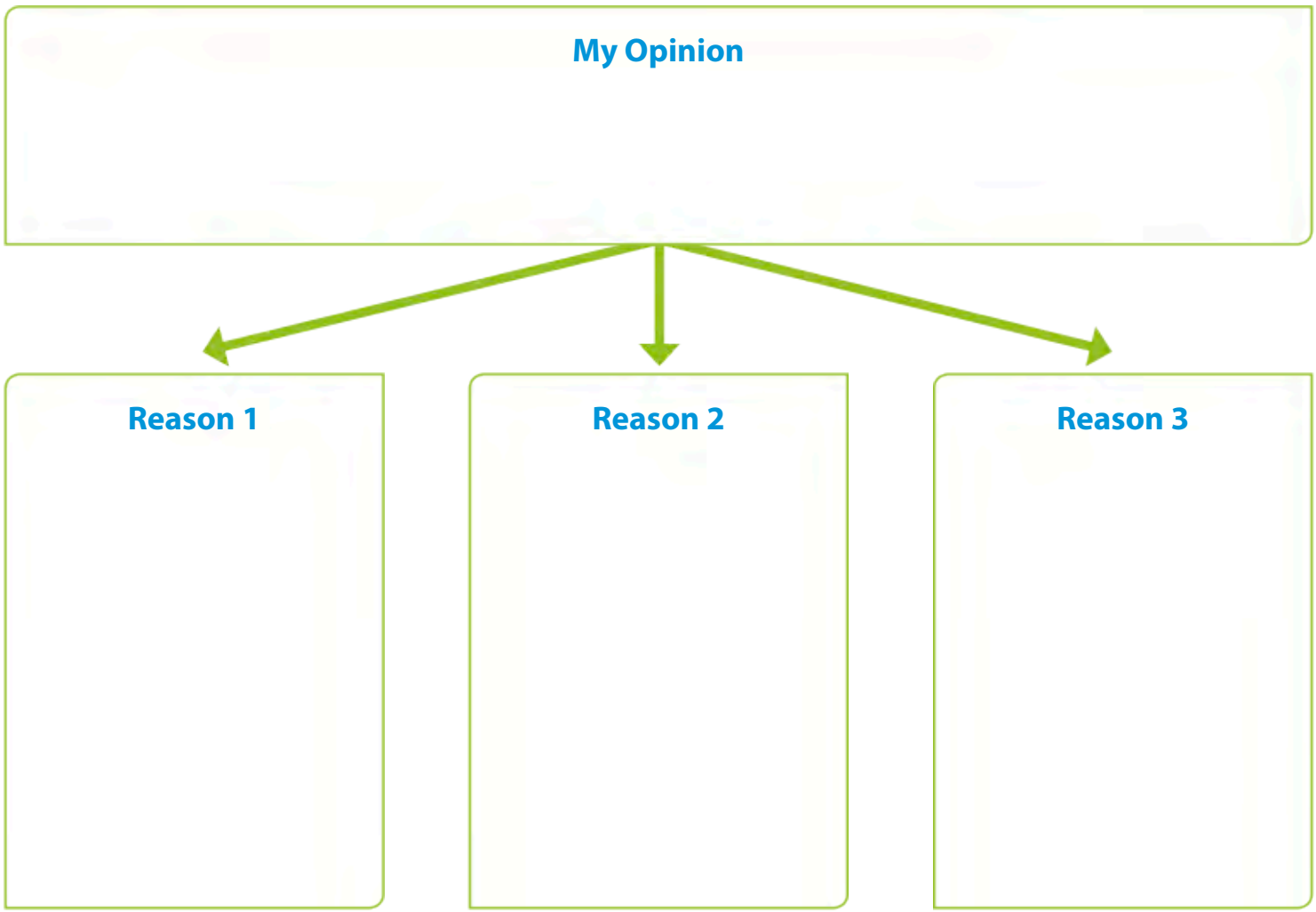
- ☐ has an introduction that clearly states your opinion.
- ☐ explains why the issue is important to your readers.
- ☐ supports your opinion with reasons in a logical order.
- ☐ has reasons supported by facts and details from the texts.
- ☐ uses words and phrases that link the opinion, reasons, and evidence.
- ☐ has a conclusion that restates the opinion and gives readers specific actions to take.

PLAN ..... Gather Information.

Decide which natural disaster you will write about. Then think about the position you will take on how to be prepared. Look back at your notes and revisit the texts and video for evidence.

Use the chart below to plan your editorial. Write your topic and a sentence that states your opinion. Then write your reasons and the evidence that supports each one. Use Critical Vocabulary Words where appropriate.

My Topic: _____



Performance Task

DRAFT ..... Write your editorial.

Write an **introduction** that states your opinion. Explain why the topic is important.

Write a **paragraph** for each reason from your planning chart. Include strong supporting details for each one. Look back at the texts if you need more evidence.

Reason 1	Reason 2	Reason 3

Write a **conclusion** that restates your opinion and sums up your reasons. End with a strong statement of what action readers should take.

REVISE AND EDIT

Review your draft.

Now it's time to revise and edit your draft. This is a chance to review your editorial and make improvements. Work with a partner or small group. Share suggestions about how to improve each other's work. Use these questions to help you evaluate and improve your editorial.

PURPOSE/ FOCUS	ORGANIZATION	EVIDENCE	LANGUAGE/ VOCABULARY	CONVENTIONS
☐ Does my introduction clearly state my opinion and why it's important? ☐ Does each reason clearly support my opinion?	☐ Are the reasons presented in a logical order? ☐ Does the conclusion restate my opinion and leave readers with an action to take?	☐ Is each of my reasons supported by strong evidence from the texts?	☐ Did I use linking words and phrases to connect the opinion, reasons, and evidence? ☐ Did I use strong action verbs?	☐ Have I spelled all words correctly? ☐ Did I use a variety of sentence types?

PUBLISH

Share your work.

Create a Finished Copy. Make a final copy of your editorial. Include an infographic or other visual for additional support. Consider these options for sharing your editorial:

1. Include your editorial in a safety brochure. Print copies and make the brochure available in the school or class library.
2. Give a speech to your class or another student group. Use expression and gestures to help show the importance of your opinion and reasons.
3. Post your editorial on a school or class website. Invite comments from your readers or other suggestions for how to prepare for a natural disaster.