TEACHER’S GUIDE

Explorer Tim Samaras

TORNADOES

Twister
Eyewitness to a Tornado
Tim Samaras, Severe Storms Researcher
Tim’s Tips for Staying Safe
Literacy Overview

Reading Selections
• Twister (science article)
• Eyewitness to a Tornado (news article)
• Tim Samaras, Severe Storms Researcher (interview)
• Tim’s Tips for Staying Safe (how-to article)

CONTENT GOAL
Students will read four selections in Explorer Tim Samaras: Tornadoes. They will learn about tornadoes, including efforts to help people stay safe during tornadoes.

COMMON CORE STATE STANDARDS FOR ENGLISH LANGUAGE ARTS
CC.4.R.1 Refer to details and examples in a text when explaining what the text says explicitly and what happened when drawing inferences from the text.
CC.4.R.2 Determine the main idea of a text and explain how it is supported by key details; summarize the text.
CC.4.R.3 Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.
CC.4.R.4 Describe the overall structure (e.g., chronology, comparison, cause/effect, problem/solution) of events, ideas, concepts, or information in a text or part of a text.
CC.4.R.5 Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.
CC.4.R.6 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.

COMPREHENSION GOAL
Remind students that as thinking-intensive readers they must listen to their inner voice to monitor and repair comprehension as they read. Find opportunities to model and teach active thinking strategies to help students access content. You may want to focus on the following strategies for Explorer Tim Samaras: Tornadoes.

• Activate and Connect to Background Knowledge:
Readers use what they know or have experienced to help them understand new information. However, they must be prepared to reverse any misconceptions in light of new learning or new evidence.

• Ask Questions: Readers expand understanding when they ask themselves questions as they read and when they ask others questions as they discuss the content. Self-questioning propels readers to discover answers, ask more questions, and do further research.
The NG Ladders on-level eBook for Explorer Tim Samaras: Tornadoes is available in .pdf format. Project the eBook on your interactive whiteboard, or have students listen to or read it on tablets or other mobile devices.

**ACTIVATE & BUILD BACKGROUND**

Draw the graphic organizer shown above. Ask: *What do you think you know about tornadoes?* Write students’ responses in the graphic organizer.

**Model** for students by thinking aloud. You might say something similar to the following: *I saw a tornado on the news. It struck a small town. The storm only lasted a few minutes, but it destroyed homes and uprooted trees. Some people were injured. So one thing I know about tornadoes is that they are extremely powerful storms. I know this even though I never experienced one myself.*

**Explain** that tornadoes can cause extensive damage to buildings and other structures and can be deadly to people. Share that severe storm researchers study tornadoes with the goal of keeping people safe from these storms. Say: *These scientists learn about how and when tornadoes form. They use the information to develop better warning systems. The warning systems give people time to seek shelter before a tornado hits. The more scientists learn about tornadoes, the more lives they can help save.*

Ask students to **Turn and Talk** about examples of severe weather or other types of natural disasters they may have read about or experienced themselves.

Students can then **Share** what they think they know about tornadoes.

You may want to return to the graphic organizer to add more information after students read each selection.

**BUILD SCIENCE BACKGROUND**

Pages 4–6 of this teacher’s guide address how certain science concepts relate to each selection in *Explorer Tim Samaras: Tornadoes*. This information will provide you with science background knowledge as you plan your teaching for this book.

Help students access background knowledge related to the science concepts. Support the understanding of tornadoes and tornado safety in ways that are familiar to your students.

- **atmosphere**: Ask students to name things that are in the atmosphere (for example, clouds, rain, flying planes). Lead them to understand that all of the outside air around them is part of the atmosphere.

- **tornado warning**: Explain that a tornado warning means that a tornado has been spotted in the area. Ask students why some communities have loud sirens that sound to warn of a tornado.

- **supercell**: Explain that a supercell is a type of storm that could develop tornadoes. Strong winds and hail are associated with supercells. Have partners share experiences of storms with strong winds or hail.
Science concepts are a critical part of each selection in Explorer Tim Samaras: Tornadoes. These pages will help you build content knowledge so that you may more effectively have discussions with students as they read each selection of the book.

The following big idea science concepts apply to several selections in the book.

- A tornado watch is given when weather conditions are right for a tornado to form in an area. The National Weather Service (NWS) uses a network of Doppler radar systems to track storms that could potentially spawn tornadoes. In contrast to a tornado watch, a tornado warning (student book pp. 15, 29) is given when a funnel cloud or a tornado (a funnel cloud that has touched down) has actually been spotted in the area.

- A supercell (student book p. 6) develops when a strong updraft of warm air rotates around a vertical axis. This rotation is caused by a wind shear—a change in wind direction and/or speed at a higher altitude. The rotating updraft is called a mesocyclone. Supercells differ from ordinary thunderstorms because the mesocyclone enables supercells to sustain themselves for a much longer period.

- Earth’s atmosphere (student book p. 8) comprises four main layers of gases that surround the planet. Weather occurs in the bottommost layer, the troposphere. Land and surface water absorb solar energy and radiate heat into the air; water evaporates as a result. Air near the surface is therefore warmer and wetter than air higher in the troposphere, setting up differences in temperature and pressure that cause air to move. Warmer air rises; cooler air sinks. As warm air meets cool air, the possibility of rapid air movement (an unstable atmosphere) exists and may lead to storms.

Pages 5–6 in this teacher’s guide describe how the science concepts above relate to each selection. Additional science background information is given for each selection.
In this selection, students will learn how tornadoes form, where they are most likely to occur, and how their strength is rated.

In the United States, tornado season lasts from April through June. During these months, conditions are prime for tornado formation, especially in the central parts of the country—Tornado Alley. However, every state in the United States has been hit by a tornado at least once, and tornadoes can strike from January to December.

Tornadoes are unique in that they are storms born from storms. A tornado needs a thunderstorm to form. Thunderstorms are classified into different categories based on their strength. The most severe type of thunderstorm, the supercell (student book, p. 6), is the parent of most tornadoes.

Supercells and tornadoes form when warm, moist air masses moving up from the Gulf of Mexico collide with cooler air masses moving down from the north, creating an unstable atmosphere (student book, p. 8). The temperature of the warm air mass is usually above 23°C (75°F). In addition to this clash of contrasting air masses, the jet stream, a fast-flowing river of upper air, must be moving quickly—at least 240 km/hr (150 mph)—for a tornado to form from supercells. The interaction of the rising warm air, downward flowing cool air, and fast jet stream produces circulation of air in the atmosphere. This circulation sometimes produces the spiraling winds of a funnel cloud. If the funnel cloud touches the ground, it becomes a tornado.

In this selection, students will read about a powerful tornado that struck Joplin, Missouri, the damage it caused, and how a tornado warning (student book, p. 15) helped save lives.

The city of Joplin, Missouri, was struck by an EF5 tornado on May 22, 2011. The tornado was about 1.2 km (0.75 miles) wide and cut a path of devastation some 21 km (13 miles) long through the area. Tornado winds exceeded 322 km/hr (200 mph), but the storm system itself moved at a relatively slow pace of 16 km/hr (10 mph).

When the storm passed, it left behind an estimated 2.7 million cubic meters (3 million cubic yards) of debris from homes and other structures. Approximately 7,500 houses were destroyed or damaged, and 161 people lost their lives. Many more were injured.

The city of Joplin estimates that some 130,000 volunteers donated their time to help residents recover. All together, the volunteers logged an astonishing 810,475 hours of service in one year. The volunteers worked alongside residents to clean out homes, complete needs assessments, and serve tens of thousands of meals.

Today Joplin is still rebuilding, but substantial progress has been made. One major symbol of the town’s rebirth is a new $450 million hospital, which replaced the former hospital that was demolished in the storm. The new hospital is reinforced with concrete walls and special windows built to withstand tornado winds of more than 400 km/hr (250 mph). To avoid generator failures that contributed to some patients’ deaths, the hospital’s generators are now located underground in reinforced bunkers with fuel to last four days.
TIM SAMARAS, SEVERE STORMS RESEARCHER

Student Book, pp. 18–27
Teacher’s Guide, pp. 11–12

In this selection, students will read an interview with tornado researcher Tim Samaras and learn about the methods and technology he used to study tornadoes, as well as how peer review helps evaluate his and other scientists’ findings.

Tim Samaras was a storm chaser—a researcher who studies tornadoes in the field. He was killed when a massive tornado struck his car in Oklahoma in May 2013.

Many scientists share Tim’s goal of improving tornado warning systems in order to save lives. The National Severe Storms Laboratory (NSSL) has ongoing projects that encourage collaboration among scientists. One such project was the Verification of the Origins of Rotation in Tornadoes Experiment 2009-2010 (VORTEX2). VORTEX2 was the world’s largest field study dedicated to gathering data about tornadoes. Some 100 scientists took part in the study, which involved studying supercells in Tornado Alley from May through June, in both 2009 and 2010.

The team used ten mobile radars and other cutting-edge technology to gather data about why and how tornadoes form. A massive amount of data was gathered for analysis. One of the main areas of research is studying the complex conditions that cause one supercell to produce a tornado, while another seemingly similar storm does not.

Additional tools used to perform research and predict tornadoes include computer models, satellites, upper air weather balloons, and surface weather stations such as the Turtle, which measures wind speed and direction, air temperature, air pressure, and humidity on the ground.

TIM’S TIPS FOR STAYING SAFE

Student Book, pp. 28–31
Teacher’s Guide, pp. 13–14

In this selection, students will learn the difference between a tornado watch and a tornado warning (student book, p. 29) as well as how to keep safe during a tornado.

The National Weather Service (NWS) offers tornado safety tips online for schools and homes. The following tips are adapted from NWS:

**Staying Safe at School**

- Perform tornado drills (during school hours and after-school activities) with a goal of getting all students and staff into safe positions within one minute.
- If a tornado watch is issued, postpone activities in gyms, cafeterias, and other large rooms.
- Many schools do not have basements. Students and staff should gather on the lowest level in protected, window-free areas, such as hallways.
- Have students practice sitting in a safe position on the ground, facing a wall, with hands over heads.
- Create an alternative way for staff to communicate during a tornado in case electrical alarm and communication systems fail during a storm.

**Staying Safe at Home**

In addition to Tim’s tips in the how-to article, families should prepare a storm safety kit before severe weather strikes. The kit can be placed in the family’s “safe room,” be it a storm shelter, basement, or lower-level interior room. The kit should include the following items:

- flashlight and batteries
- first aid kit
- radio
- one change of clothes for each family member
- three-day supply of water and nonperishable food
- kitchen items (can opener, utensils, plastic bags)
- personal items (soap, deodorant, toothpaste, toothbrushes, toilet paper)
“Twister” is a science article that explains how tornadoes form and why they vary in strength and size. The article uses vivid images to illustrate the kind of damage tornadoes can cause and introduces the Enhanced Fujita (EF), a system for ranking tornadoes based on their destructive power. The article begins with a brief summary of the work of Tim Samaras, a severe storms researcher who lost his life in the pursuit of scientific knowledge.

BUILD BACKGROUND FOR THE GENRE

Let students know they are about to read a science article. Explain that science articles are found in magazines, newspapers, and online. Let them know that “Twister” is a science article with the following elements:

• It gives facts, details, examples, and evidence about tornadoes.
• It explains causes and their effects.
• Facts and information are presented through photos, captions, diagrams, charts, and a map.

BUILD VOCABULARY & CONCEPTS

- updraft
- downdraft
- supercell
- atmosphere
- velocity
- funnel
- waterspout
- fire whirl
- Enhanced Fujita (EF)

Remind students that Using Context Clues is a strategy to infer the meaning of an unfamiliar word. They can “read around” the word, or read a few sentences before and after it, to make meaning from the context. Remind them to look at the photos and diagrams, too.

Another strategy to try is Using Visual Vocabulary. Turn to student page 4 and model how to use the images to clarify the meanings of new vocabulary. Point out the arrows and the use of color in the diagrams about updrafts and downdrafts. Ask: Based on the diagrams, what do you think the term updraft means? Have students turn and talk with a partner and then scan the text to see if their response was accurate. Ask the same question for the term downdraft. Then have students look through the text to find visuals that help them understand what atmosphere, velocity, and supercell refer to.

Have pairs use these strategies to determine the meaning of funnel, waterspout, fire whirl, and any other important words.
READ

The content goal for Explorer Tim Samaras: Tornadoes is to learn about tornadoes, including efforts to help people stay safe during tornadoes. Remind students that each selection in Explorer Tim Samaras: Tornadoes involves a different perspective on these severe storms. In “Twister,” students will learn how tornadoes form and how they are classified. Point out the Read to find out statement on page 2: Read to find out more about tornadoes.

Help students achieve the comprehension goal of accessing the content by asking questions as they read. Model by pointing out the image on page 3. Say: Whenever I see a photo of a tornado, it has a funnel shape—wider at the top than at the bottom. I wonder why a tornado takes that shape. I’ll read with that question in mind, looking for the answer. If the text doesn’t answer my question, I can do further research to find out why.

Before students begin reading, say: As you read, note what you wonder or have questions about. If you don’t find the answers in the text, you might ask others or do further research.

TURN & TALK

Revisit the Read to find out statement. Have students turn and talk to tell what they learned about tornadoes. To check understanding, have students turn and talk about the Check In question: How does a tornado form? (Possible response: A tornado forms when updrafts and downdrafts wrap around each other and create a swirling funnel of air that touches the ground.)

Describe Text Structure Remind students that a cause makes something happen; an effect is what happens because of the cause. Explain that identifying cause-and-effect relationships is central to understanding the big ideas in a text. Point out an example of such a relationship on pages 4 and 5 of the text—read the steps that tell how a tornado forms. Explain that when warm air and cool air collide and wrap around each other (the cause), a swirling funnel of air forms (the effect). Help students recognize other cause-and-effect relationships in the text. Ask: What causes the funnel shape of the tornado to be visible? (The tornado picks up debris from the ground.)

Have partners identify and share at least two other cause-and-effect relationships in the text. One partner can state the cause and the other can state the effect. As an alternative, partners can work together to make cause-and-effect graphic organizers or digital posters.

Interpret Information Encourage students to use the diagrams and other graphics in the text to solidify their understanding. Direct students’ attention to the diagrams on pages 4 and 5. Ask: What do these diagrams show? (how a tornado forms) What is a requirement for a tornado to begin forming? (Cold air and warm air must meet each other, causing a horizontal tube of air to spin.)

Next, direct students’ attention to the EF chart on pages 10 and 11. Remind them that this chart ranks tornadoes according to their wind speed and the damage they cause. Place students in small groups. Have group members take turns calling out a wind speed or a characteristic of tornado damage described in the chart, such as “windows broken.” Have other group members identify the rating of the tornado. (“Windows broken” is associated with EF1 tornadoes.) Allow students to refer to the article as they do this activity.

WRITE & ASSESS

You may want to have students do a “quick write” to assess understanding. It’s always helpful to have students reflect on both the content of the selection and their thinking process.

• Describe conditions in the atmosphere that can cause a tornado.
• What questions did you ask yourself as you read about tornadoes? Were all of your questions answered? If not, how could you find the answers?
Eyewitness to a Tornado

Summary
“Eyewitness to a Tornado” is a news article that gives firsthand accounts of one of the worst tornadoes in recent history. In their own words, citizens of Joplin, Missouri, share what it was like to live through a deadly EF5 tornado in 2011. The article concludes with a description of efforts to rebuild Joplin.

BUILD BACKGROUND FOR THE GENRE
Hold up a newspaper or project the home page of an Internet news site. Then ask students what they think a news article is. Also ask what topics might be included in news articles. Have them turn and talk to share what they think they know. Lead students to understand the elements of news articles.

• It is a factual report that gives information about a recent event.
• It answers questions that begin with the 5 Ws: what, when, who, where, and why.
• It includes quotations from witnesses or experts.

BUILD VOCABULARY & CONCEPTS
• supercell
• tornado warning

Remind students that Using Context Clues is a strategy to infer the meaning of an unfamiliar word. They can “read around” the word, or read a few sentences before and after it, to make meaning from the context. Remind them to look at the photographs, too.

Try the strategy Using Background Knowledge to help students understand unfamiliar terms. Have students find the words tornado warning on page 15. Have them turn and talk about what they think the term means based on how they may have heard it used. Point out that they might have also heard a similar term, tornado watch. Then have them read tornado warning in context. Invite students to share their ideas about its meaning. Have a class discussion and collaboratively construct a clear understanding of the term. Have student pairs follow the same steps with the word supercell.

Point out other important words in the selection, such as deploy, crawlspace, and tragedy, for which students may be able to use their background knowledge to determine the meaning.
READ

The content goal for Explorer Tim Samaras: Tornadoes is to learn about tornadoes, including efforts to help people stay safe during tornadoes. Explain that “Eyewitness to a Tornado” includes firsthand accounts of people who lived through a deadly tornado. Point out the Read to find out statement at the top of page 12 in the student book: Read to find out about one of the worst tornadoes in recent history.

Help students achieve the comprehension goal of accessing the content by activating and connecting to background knowledge as they read. Model by reading aloud the quote at the top of page 13 and recounting an experience you have had with a storm. Say something similar to: I’m sure Emma Cox wanted to get home fast. I was at a park once when a storm was approaching. The clouds were so dark. The thunder and lightning were getting closer and closer! I knew I wouldn’t make it home before the storm hit, so I ran to a friend’s house. Luckily, she was home.

Before students begin reading, say: Use what you know or what you have experienced about storms to help you understand the information in the news article. Think of ideas you already have about tornadoes. As you read, be aware that some of these ideas may be inaccurate, and you may have to replace them with the new knowledge you acquire.

TURN & TALK

Revisit the Read to find out statement. Have students turn and talk to tell what they learned about one of the worst tornadoes in recent history. To check understanding, have students turn and talk about the Check In question: What are some things you could do to prepare for a tornado? (Possible response: Seek shelter in a basement or crawlspace as soon as you hear tornado-warning sirens go off. Build a storm shelter.)

Draw Inferences Ask students to review pages 13–16. Then have them turn and talk, using background knowledge (what they already know) along with details and examples in the text to make inferences about how people who experienced the Joplin tornado must have felt. (Students may infer that Emma and Kurtis Cox were scared because their car rocked and they heard a spooky whistling sound; that Terrla Cruse was scared because she heard the tornado roar and house shake; that the Conners were grateful but sad because they survived while some neighbors didn’t.)

Explain Events Remind students of the 5 Ws that journalists use to write news articles: what, when, who, where, and why. Tell students to turn to page 12 and ask questions to help them explain what occurred. Ask: Who is this page about? (Tim Samaras) Where was Tim? (in Joplin, Missouri) Why was he there? (His team was chasing a thunderstorm.) What was happening? (A tornado was forming.) When did the tornado strike? (May 22, 2011)

Assign student pairs a page in the article. Have them turn and talk, using the same questioning technique to explain other events in the article.

WRITE & ASSESS

You may want to have students do a “quick write” to assess understanding. Have students reflect on both the content of the selection and their thinking process.

• How are the people of Joplin preparing for severe storms in the future?
• What connections do you have to your reading?
“Tim Samaras, Severe Storms Researcher” is an interview with a researcher who spent years studying tornadoes up close. His work improved tornado-warning systems. The interview covers Tim’s early fascination with tornadoes and his methods and contributions to understanding these deadly storms.

BUILD BACKGROUND FOR THE GENRE

Lead students to an understanding of the elements of an interview. Explain that “Tim Samaras, Severe Storms Researcher” is an interview and has the following elements:

• It is a text that is organized into a series of questions and answers.
• It is based on a conversation or written exchange between an interviewer (National Geographic) and interviewee (Tim Samaras).
• The interviewer and interviewee are identified at the beginning of each question or answer.

BUILD VOCABULARY & CONCEPTS

• peer review

Remind students that Using Context Clues is a strategy to infer the meaning of an unfamiliar word. They can “read around” the word, or read a few sentences before and after it, to make meaning from the context. Remind them to look at the photographs, too.

Another helpful strategy is Using Graphic Organizer Notes. On the board, sketch a graphic organizer with four columns. Label the columns Word, Inferred Meaning, Clue, and Sentence or Picture, respectively. Ask students to copy the graphic organizer into their notebooks. Direct them to write the term peer review in the first column. Ask: What do you think this term means? Have students write their thoughts in the second column. Then direct students to page 26 and have them identify clues that help them determine the meaning of peer review. They should record the clues in the third column of their chart, and then use the term in a sentence or draw a picture illustrating the term in the fourth column.

Have students use graphic organizer notes and context clues to determine the meaning of device, engineering, elements, technology, and any other important words that might be unfamiliar or challenging.
READ

The content goal for Explorer Tim Samaras: Tornadoes is to learn about tornadoes, including efforts to help people stay safe during tornadoes. In “Tim Samaras, Severe Storms Researcher,” students will learn how one scientist used science, technology, engineering, and math to study tornadoes for the purpose of improving tornado safety. Point out the Read to find out statement at the top of page 18 in the student book: Read to find out about Tim Samaras’s tornado research.

Help students achieve the comprehension goal of accessing the content by asking questions as they read. Model by reading aloud the bottom paragraph on page 19. Say: Tim led a team that is part of the Tactical Weather Instrumented Sampling in or near Tornadoes Experiment. I can tell by the title that the team studies tornadoes. But I’m not sure exactly what they do. I wonder what “instrumented sampling” means? What instruments do they use to study tornadoes? I’m going to read on to find out.

Before students begin reading, say: You may find it helpful to write down your questions as you read. This will help you focus on finding answers to your questions. Also, think of yourself as the interviewer when you read this article. What questions would you ask to clarify information or to gain more information about details in the article?

TURN & TALK

Revisit the Read to find out statement. Have students turn and talk about Tim’s Samaras’s tornado research. To check understanding, have students turn and talk about the Check In question: What other questions would you ask a severe storms researcher? (Possible responses: How many tornadoes have you seen in person? How does math help you study tornadoes? What is it like being near a tornado? What are the sights and sounds?)

Draw Inferences Remind students that an inference is a conclusion that is not stated directly in the text. Guide them to make inferences by using details in the text in addition to what they already know. Direct students’ attention to page 19. Say: Tim and his team quickly released their instruments and just as quickly drove away. What can you infer about the situation from the team’s actions? (The team felt they were in particular danger and so acted quickly to get out of danger.)

Have student pairs discuss other inferences they can draw from the text. Ask questions to help them, such as: On page 25, why did Tim want to focus future research efforts on thunderstorms? (Possible response: Tornadoes form from thunderstorms, so knowing more about thunderstorms will help scientists learn more about tornadoes.) Have pairs share inferences with the class.

IDENTIFY TEXT STRUCTURE Explain that this selection has a problem/solution text structure: Tim Samaras tells how engineering skills can be used to solve problems related to tornadoes. Then model how to determine a problem and a solution. Say: On page 22, I read that devices to measure tornadoes aren’t sold at stores. I know that Tim needs such devices, so that’s a problem. Then I read that Tim used engineering skills to design his own weather devices since he can’t buy them. That’s a solution.

Have students review the text and turn and talk to describe instances of problems and solutions. (Possible responses: Problem: tornadoes are dangerous / Solution: create better warning systems. Problem: engineering skills are needed to develop tools / Solution: take science and math classes, ask questions, and be creative. Problem: scientists want to forecast tornadoes more quickly / Solution: scientists share ideas in peer reviews.)

WRITE & ASSESS

You may want to have students do a “quick write” to assess understanding. It’s always helpful to have students reflect on the content and their thinking process.

• What skills does a storm researcher need?
• What research would you like to do about this topic?
“Tim’s Tips for Staying Safe” is a how-to article that describes steps to take to stay safe during a tornado. It explains the difference between a tornado watch and a tornado warning and tells what to do if an alert is issued for your area. The article also gives different options for staying safe in the event you are caught outdoors or in a structure that does not have a basement.

BUILD BACKGROUND FOR THE GENRE

Ask what students would expect to find in a text labeled a “how-to article.” Tell students they will read “Tim’s Tips for Staying Safe,” a how-to article with the following elements:

• The text begins with a goal.
• The text provides directions on how to accomplish the goal.
• Unfamiliar terms are defined or explained.

BUILD VOCABULARY & CONCEPTS

• tornado watch
• tornado warning

Remind students that Using Context Clues is a strategy to infer the meaning of an unfamiliar word. They can “read around” the word, or read a few sentences before and after it, to make meaning from the context. Remind them to look at the photographs, too.

Another strategy to try is Becoming Wordkeepers. Explain that a “wordkeeper” takes care of words. Tell students that you are going to give away the term tornado watch. Write the term on a sticky note and ask if anyone knows its meaning. Discuss the meaning and write it on the sticky note. Call on one of the volunteers to be the wordkeeper for tornado watch. Give the volunteer the sticky note, and have him or her read the meaning aloud. Tell other students they can ask the wordkeeper about this term if they forget its meaning. Repeat with the term tornado warning.

Point out other important words in the selection, such as accurate, issued, and permanent. Designate a wordkeeper for these words and any other important words that might be unfamiliar to students.
READ

The content goal for Explorer Tim Samaras: Tornadoes is to learn about tornadoes, including efforts to help people stay safe during tornadoes. Remind students that each selection in Explorer Tim Samaras: Tornadoes involves a different perspective on these severe storms. Share that “Tim’s Tips for Staying Safe” explains what safety measures people should take if a tornado is spotted in their area. Point out the Read to find out statement at the top of page 28 in the student book: Read to find out how to stay safe from the dangers of a tornado.

Help students achieve the comprehension goal of accessing the content by activating and connecting to background knowledge as they read. Model by reading the top of page 30 aloud. Say, The text says to have a plan to follow during a tornado. My family has a plan to stay safe in case of severe weather at home. We also have a plan at school. Turn and talk about what you know about our severe weather safety plan at school.

Before students begin reading, say: As you read, think about what you already know about safety during severe weather. You may read something that disagrees with what you thought you were supposed to do. If that happens, adjust your thinking.

TURN & TALK

Revisit the Read to find out statement. Have students turn and talk about how to stay safe from the dangers of a tornado. To check understanding, have students turn and talk about the Check In question: Describe the steps you should follow to stay safe from a tornado. (Possible response: If you are outside, in a car, or in a mobile home, seek shelter in a permanent building. Go to a basement or a room without windows. Protect your head with your arms. If you are in an open area, seek shelter in a ditch or other low place.)

Draw Inferences Tell students that making inferences can help them better understand the text. Remind them that they can use details in addition to what they already know to make inferences. Have students turn to page 30. Ask: Why do you think you should you go to a room without windows? (The strong winds of a tornado can break glass, and you could get injured from flying pieces of glass.) Have student pairs discuss other inferences they can draw from the text, such as why Tim recommends seeking shelter in a ditch or other low area if you are caught outside during a tornado. Discuss as a class and address any misconceptions students may have.

Determine Main Ideas Tell students that visual elements such as titles, boldfaced words, and labels can help them to determine the main ideas of a text. Have students turn to page 28 and study its visual elements. Ask: Based on the visual elements, what do you think is the main idea of this article? (how to stay safe during a tornado) What clues did you use? (Possible response: the title and the “Read to find out” question) Have partners scan the pages and identify other clues that help them determine the main idea of each section.

WRITE & ASSESS

You may want to have students do a “quick write” to assess understanding. It’s always helpful to have students reflect on the content and their thinking process.

• What is the difference between a tornado watch and a tornado warning?
• What do you still wonder about tornado safety?
Discuss

What helps people stay safe during tornadoes?

- Understanding tornadoes helps researchers predict them so people can prepare.
- A basement or storm shelter can help people stay safe.
- Accurate tornado warnings help people stay safe. This is a goal of research.
- A tornado safety plan helps people stay safe.

The four selections in Explorer Tim Samaras: Tornadoes are a science article, a news article, an interview, and a how-to article. Earth science concepts (formation and impact of tornadoes and research to improve tornado safety) thread through the selections. Guide a discussion about these science concepts.

What makes the selections especially interesting, though, is the interdisciplinary context—real-life stories and events that include not only earth science but also biography, geography, current events, engineering, and technology. Have students turn and talk about the interdisciplinary nature of the selections. You might ask: How is reading Explorer Tim Samaras: Tornadoes different from reading a textbook about tornadoes? Also ask them to consider differences in the ways the selections were written (such as genre, text structure, and point of view) and how the writing style helps the science concepts come alive.

EXPLORER TIM SAMARAS: TORNADOES | DISCUSS

CONTENT & COMPREHENSION GOALS

Guide students to discuss what they learned in the four selections of Explorer Tim Samaras: Tornadoes. Ask: What helps people stay safe during tornadoes? (Possible responses are given in the concept map. Students may provide more or different information.)

REVIEW OBJECTIVES

- Ask and answer questions to demonstrate understanding.
- Explain events, procedures, and ideas based on information in the text.
- Integrate information from texts on the same topic.

SCIENCE OBJECTIVES

- Identify how tornadoes affect people.
- Know how to stay safe during a tornado.

COMMON CORE STATE STANDARDS FOR ENGLISH LANGUAGE ARTS

CC.4.Rlifo.1 Refer to details and examples from a text when explaining what the text says explicitly and when drawing inferences from the text.

CC.4.Rlifo.3 Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.

CC.4.Rlifo.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.

A FRAMEWORK FOR K–12 SCIENCE EDUCATION

Core Idea ESS3: Earth and Human Activity
ESS3.B. Natural Hazards
How do natural hazards affect individuals and societies?

Core Idea ETS2: Links Among Engineering, Technology, Science, and Society
How are engineering, technology, science, and society interconnected?

EXPLORER TIM SAMARAS: TORNADOES | DISCUSS

15
DISCUSS

Have students collaboratively answer the questions on page 32 as you move about the room and listen in to support and scaffold student conversations and clarify misconceptions.

1. **How does the information you read about in the interview with Tim Samaras relate to the other selections?** (Possible response: Tim Samaras told about how he used science to find out more about tornadoes in order to improve safety. The three other selections in the book are all about tornadoes. We learn about what tornadoes are and how they form, how tornadoes can be dangerous to people and buildings, and how to protect ourselves from tornadoes.)

2. **What new ideas or concepts about tornadoes did you learn about from this book?** (Answers will vary. Students may talk about how tornadoes form, different kinds of tornadoes, how powerful tornadoes are, how Tim Samaras used science to find out about tornadoes, or how to make your home safe in case a tornado strikes.)

3. **In what ways do you think science, technology, engineering, and math are related in understanding severe storms better?** (Students may use the example of Tim Samaras in their responses. Tim demonstrated that he used his science, technology, engineering, and math skills together in order to carry out his research. His math and engineering skills helped him design the equipment he needed to track tornadoes. His understanding of technology helped him select the best tools for his research. Tim showed that his scientific research depended on and was connected to his knowledge of technology, engineering, and math.)

4. **What are some things you could do to stay safe in the event of a tornado?** (Possible response: Listen to the news for updates about the storm. Seek shelter inside a home or other building on the lowest level or in a basement. Get under heavy furniture and protect your head with your arms.)

5. **What other questions do you have about tornadoes? Where could you find answers to your questions?** (Answers will vary, but students should explain their responses and describe a variety of references, such as books and magazine articles, reliable Internet sites, and talking with experts.)
Research & Share

In small groups or individually, offer students the chance to explore questions they have or ideas they still wonder about, based on their reading in Explorer Tim Samaras: Tornadoes. Use question 5 on the Discuss page of the student book as a springboard for student questions and ideas for further research.

EXPLORE

Encourage students to express their curiosity in their own way. The questions students have matter. You might have students talk with peers, write about what they wonder, or create drawings based on what they learned from reading the different selections in Explorer Tim Samaras: Tornadoes. Guide them to immerse themselves in resources related to what they are most interested in learning more about. They might ask questions or make statements about their interests, for example:

- What research are other scientists doing on tornadoes?
- What technology do engineers use to make buildings better able to withstand a tornado?
- How do tornadoes affect animals and plants?

GATHER INFORMATION

After students explore, they should arrive at a question that will drive their research. Students may want to read, listen to, and view information with their question in mind. Guide students to use resources, such as reliable sites on the Internet, science texts and articles, library books, and magazines that address the question they posed. Collecting information may lead students to revise or narrow their question.

Teach students how to keep track of their thinking and findings as they gather information. Present some options for note taking. Students may want to use the Fact-Question-Response (FQR) format. Have students keep track of their sources in their FQR notes.
ANALYZE & SYNTHESIZE

Guide students to carefully and thoughtfully review their notes to determine the big ideas related to their question. As students prepare to use the information they’ve gathered to formulate an answer to their question, support them as they analyze and synthesize. Be sure they do the following:

- Revise any misconceptions.
- Notice incongruities in their information.
- Evaluate all the various pieces of information.
- Pull together the most pertinent information that addresses their question.

While analyzing and synthesizing their research, students may realize that the more they learn, the more they wonder. To help focus their thinking, students may want to talk with classmates or write in a research notebook. Remind them that just as in real-world scientific research, there may not be a final answer to the question they posed.

SHARE

When students share their research, they become teachers, consider how their ideas were shaped by the investigation, and pose new questions. Students may express their knowledge by writing, speaking, creating a visual piece, or taking action in the community. The best culminating projects are ones with authentic purposes. For example, the student who is concerned about making buildings safer during a tornado can visit the FEMA (Federal Emergency Management Agency) website. He or she can explain that design plans for safe rooms can be found online. The student may want to download and print out a sample plan to share with the audience.

When students are given the time to gather information about a topic that interests them, they will find unique and individual ways to share what they learned. Some options you can suggest might include the following:

- eBooks with photos and text to share with other students who are building background on the topics
- Short documentary films about how to stay safe during a tornado
- A computer-generated blueprint for building a school that can withstand tornadoes and other storms
OBJECTIVES
• Use a mentor text as a writing model.
• Plan and research information on a topic.
• Write and revise an interview.
• Publish and present an interview.

GENRE: INTERVIEW
Hold up “Tim Samaras: Severe Storms Researcher.” Review with students the elements of an interview.
• The text is organized into a logical series of questions and answers.
• The text is based on a conversation or written exchange between an interviewer and interviewee.
• The interviewer and interviewee are identified at the beginning of each question or answer.

MENTOR TEXT
Use “Tim Samaras: Severe Storms Researcher” as a mentor text, or a model, for student writing.
Model the elements of an interview. Walk students through the selection, sharing your thinking as you go.
Point out that the interview begins with a brief biography of the interviewee, or person being interviewed. Say: Then the interview itself begins on page 20. The interviewer—in this case, someone representing National Geographic—is identified at the beginning of each question. The interviewee—Tim Samaras—is identified at the beginning of each answer. I see that the names of the interviewer and interviewee are different colors. These elements help me to keep track of who is talking during the interview.
Explain that students can use this article as a mentor text to help them write their own interview. Tell students that our best writing teachers are the professional writers whose work we read. Suggest that they look closely at what the writer does to convey information in a clear way. Say: This interview groups questions into different sections. Look at the title on page 20. The first questions in the interview are about identifying and describing problems. On page 22, the head reads “Engineering Solutions.” This lets the reader know that the questions and answers that follow will be about using engineering to solve problems. Point to the diagrams, photos, and captions on pages 22 and 23. Say: These graphics help the reader better visualize the topics discussed on these pages. You may want to think about using graphics to illustrate your interview.

COMMON CORE STATE STANDARDS FOR ENGLISH LANGUAGE ARTS
CC.4.Write.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly. a. Introduce a topic clearly and group related information in paragraphs and sections; include formatting (e.g., headings), illustrations, and multimedia when useful to aiding comprehension. b. Develop the topic with facts, definitions, concrete details, quotations, or other information and examples related to the topic. c. Link ideas within categories of information using words and phrases (e.g., another, for example, also, because). d. Use precise language and domain-specific vocabulary to inform about or explain the topic. e. Provide a concluding statement or section related to the information or explanation presented.
CC.4.Write.4 Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.
CC.4.Write.5 With guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, and editing.
CC.4.Write.6 With some guidance and support from adults, use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others; demonstrate sufficient command of keyboarding skills to type a minimum of one page in a single sitting.
CC.4.Write.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.
Ask students to **Turn and Talk** about a topic related to natural hazards that they think would be interesting to interview someone about. (Possible ideas: How does your work help keep people safe from floods? What technology do you use to study hurricanes?)

Have several students **Share** their ideas.

**Wrap up** by explaining that students will be writing their own short interview, using “Tim Samaras: Severe Storms Researcher” as a mentor text. Students may need to do some research to find accurate information about their science topic and to locate a person to interview.

**WRITING PROCESS**

**Plan and Research** Once students have chosen a topic for their interview, they may need to research before they create interview questions. Guide students in finding appropriate, reliable, and up-to-date resources. At this time, work with students to compile a list of experts who are willing to be interviewed. The experts may be local, state, or federal government employees, faculty from nearby universities, or someone students personally know. Students can conduct the interview in person or via phone or email. They should:

- Write their questions beforehand.
- Listen carefully and let the interviewee do most of the talking.
- Ask follow-up questions to access deeper levels of information, even if that means departing from the list of prepared questions.

If students are conducting the interview in person, suggest that they use a recording device, asking the interviewee for permission to do so. They should also take notes in case they want to refer to them as they ask follow-up questions during the interview.

**Write** Students can use background knowledge, planning, and the interview recording and notes to begin writing. Remind them to look back at the mentor text to use as a model for their own writing of an interview.

Share that with this genre, accuracy is key. Say: *Your job as the interviewer is to make sure that you correctly quote the interviewee. If you recorded the interview, then carefully listen to each answer as you write it down. Make sure you use the interviewee’s exact words. Remember to identify the interviewer and the interviewee at the beginning of each question or answer. Then ask yourself which concepts are most difficult to understand, and consider using graphics to help illustrate those concepts. Graphics that support the interview can be downloaded from the Internet or created on a computer-graphics program. Or you can draw them and place them in the article. You can also ask your interviewee if they have any visuals they would like to share. Remember, you can always refer to the mentor text for guidance.*

**Conference and Revise** Have students hold a writing conference with a partner to review their drafts. Ask them to look for elements of an interview as they review their partner’s writing. Have them ask their partners the following questions.

- What struck you about the piece? (to highlight interesting parts)
- What do you wonder or want to know more about? (to suggest ideas for adding information or revising)
- Are there any confusing parts? (to pinpoint areas to revise for clarity and accuracy)

After students get feedback from a partner, have them revise and edit their writing.

**Publish and Present** Find opportunities for students to publish and present in authentic, relevant, and significant ways. Use or adapt the following ideas to best reflect your classroom goals and individual student interests.

- Film the interview and share it with other classrooms or post it on a class website.
- Role-play the interview for another class or on a family night, with the student writer being the interviewer and another student the interviewee.
Correlation

Grade 4 Common Core State Standards for English Language Arts and A Framework for K–12 Science Education correlated to National Geographic Ladders Science

<table>
<thead>
<tr>
<th>Common Core State Standards for English Language Arts, Grade 4</th>
<th>Explorer Tim Samaras: Tornadoes Teacher’s Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reading Standards for Informational Text</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Key Ideas and Details</strong></td>
<td></td>
</tr>
<tr>
<td>1. Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.</td>
<td>Pages 9–16</td>
</tr>
<tr>
<td>2. Determine the main idea of a text and explain how it is supported by key details; summarize the text.</td>
<td>Pages 13–14</td>
</tr>
<tr>
<td>3. Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.</td>
<td>Pages 9–10, 15–16</td>
</tr>
<tr>
<td><strong>Craft and Structure</strong></td>
<td></td>
</tr>
<tr>
<td>4. Determine the meaning of general academic and domain-specific words or phrases in a text relevant to a grade 4 topic or subject area.</td>
<td></td>
</tr>
<tr>
<td>5. Describe the overall structure (e.g., chronology, comparison, cause/effect, problem/solution) of events, ideas, concepts, or information in a text or part of a text.</td>
<td>Pages 7–8, 11–12</td>
</tr>
<tr>
<td>6. Compare and contrast a firsthand and secondhand account of the same event or topic; describe the differences in focus and the information provided.</td>
<td></td>
</tr>
<tr>
<td><strong>Integration of Knowledge and Ideas</strong></td>
<td></td>
</tr>
<tr>
<td>7. Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.</td>
<td>Pages 7–8</td>
</tr>
<tr>
<td>8. Explain how an author uses reasons and evidence to support particular points in a text.</td>
<td></td>
</tr>
<tr>
<td>9. Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.</td>
<td>Pages 15–16</td>
</tr>
<tr>
<td><strong>Range of Reading and Level of Text Complexity</strong></td>
<td></td>
</tr>
<tr>
<td>10. By the end of the year, read and comprehend informational texts, including history/social studies, science, and technical texts, in the grades 4–5 text complexity band proficiently, with scaffolding as needed at the high end of the range.</td>
<td>If the entire NG Ladders Science grade 4 program is used throughout the year, students will have had exposure to multiple genres, multiple levels, and appropriate scaffolding.</td>
</tr>
<tr>
<td><strong>Writing Standards</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Text Types and Purposes</strong></td>
<td></td>
</tr>
<tr>
<td>1. Write opinion pieces on topics or texts, supporting a point of view with reasons and information.</td>
<td></td>
</tr>
<tr>
<td>2. Write informative/explanatory texts to examine a topic and convey ideas and information clearly.</td>
<td>Pages 19–20</td>
</tr>
<tr>
<td>3. Write narratives to develop real or imagined experiences or events using effective technique, descriptive details, and clear event sequences.</td>
<td></td>
</tr>
</tbody>
</table>

(cont. on p. 22)
### Production and Distribution of Writing

1. Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience. Pages 19–20

2. With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, and editing. Pages 19–20

3. With some guidance and support from adults, use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others; demonstrate sufficient command of keyboarding skills to type a minimum of one page in a single sitting. Pages 19–20

### Research to Build and Present Knowledge

4. Conduct short research projects that build knowledge through investigation of different aspects of a topic. Page 17–18

5. Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources. Page 17–18

6. Draw evidence from literary or informational texts to support analysis, reflection, and research. Page 17–18

### Range of Writing

7. Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. Page 17–20

### A Framework for K–12 Science Education

<table>
<thead>
<tr>
<th>Core Idea ESS2: Earth’s Systems</th>
<th>Explorer Tim Samaras: Tornadoes Teacher’s Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESS2.D: Weather and Climate</td>
<td>Pages 4–8</td>
</tr>
<tr>
<td>What regulates weather and climate?</td>
<td></td>
</tr>
</tbody>
</table>

| Core Idea ESS3: Earth and Human Activity | Pages 4–6, 9–10, 13–16 |
| ESS3.B: Natural Hazards              |                         |
| How do natural hazards affect individuals and societies? |                         |

| Core Idea ETS1: Engineering Design | Pages 4–6, 11–12 |
| ETS1.A: Defining and Delimiting a Solution |                         |
| What are the criteria and constraints of a successful solution? |                         |

| Core Idea ETS2: Links Among Engineering, Technology, Science, and Society | Pages 11–12, 15–16 |
| How do engineering, technology, science, and society interconnected? |                         |
Glossary

atmosphere (noun) the layer of air surrounding Earth
downdraft (noun) a downward moving air current
peer review (noun) the process of scientists publishing scientific papers for others to review, discuss, and evaluate
supercell (noun) a type of storm that has the potential of developing severe and dangerous tornadoes
tornado warning (noun) an alert issued when a tornado has formed and has been sighted in an area
tornado watch (noun) an alert issued when weather conditions are right for a tornado to form in an area
updraft (noun) an upward moving air current
velocity (noun) the speed and direction of an object

ACKNOWLEDGMENTS
Grateful acknowledgment is given to the authors, artists, photographers, museums, publishers, and agents for permission to reprint copyrighted material. Every effort has been made to secure the appropriate permission. If any omissions have been made or if corrections are required, please contact the Publisher.

Credits

Copyright © 2015 National Geographic Learning, Cengage Learning

ALL RIGHTS RESERVED. No part of this work covered by the copyright herein may be reproduced, transmitted, stored, or used in any form or by any means graphic, electronic, or mechanical, including but not limited to photocopying, recording, scanning, digitizing, taping, web distribution, information networks, or information storage and retrieval systems, except as permitted under Section 107 or 108 of the 1976 United States Copyright Act, without the prior written permission of the publisher.

National Geographic and the Yellow Border are registered trademarks of the National Geographic Society.

For permission to use material from this text or product, submit all requests online at cengage.com/permissions

Further permissions questions can be emailed to permissionrequest@cengage.com

Visit National Geographic Learning online at NGL.Cengage.com
Visit our corporate website at cengage.com

ISBN: 978-12853-5978-6

1111