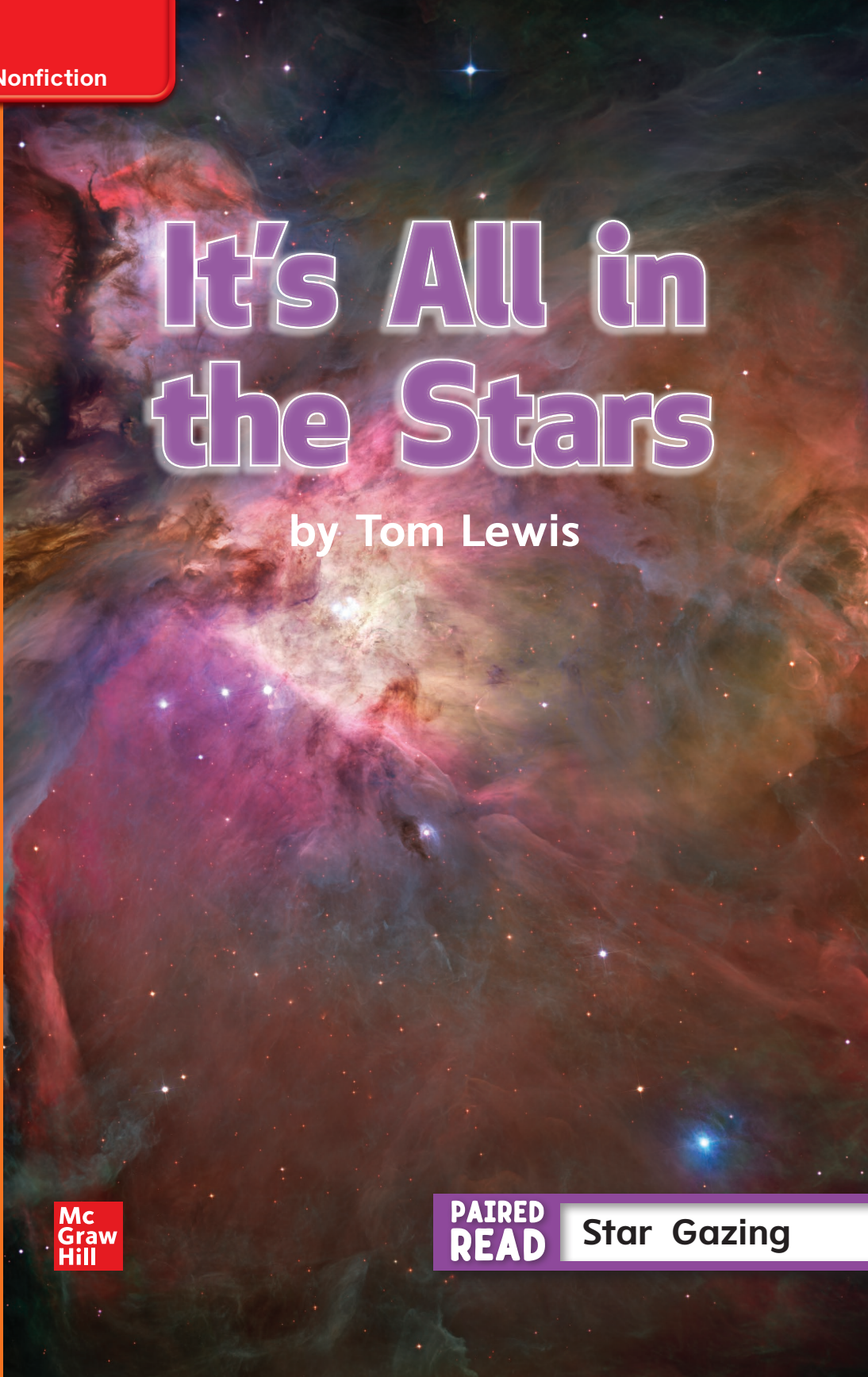
Nonfiction

It's All in the Stars

by Tom Lewis



Mc Graw Hill

PAIRED READ

Star Gazing

STRATEGIES & SKILLS

Comprehension

Strategy: Summarize

Skill: Ask and Answer Questions

Vocabulary Strategy

Homographs

Vocabulary

constellation, galaxy, light-year, nebula, solar system, star, supernova

Content Standards

Science

Earth and Space Science

Word Count: 1198**

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**The total word count is based on words in the running text and headings only. Numerals and words in captions, labels, diagrams, charts, and sidebars are not included.

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Genre Nonfiction

Essential Question

What are stars, and why are some brighter than others?

It's All in the Stars

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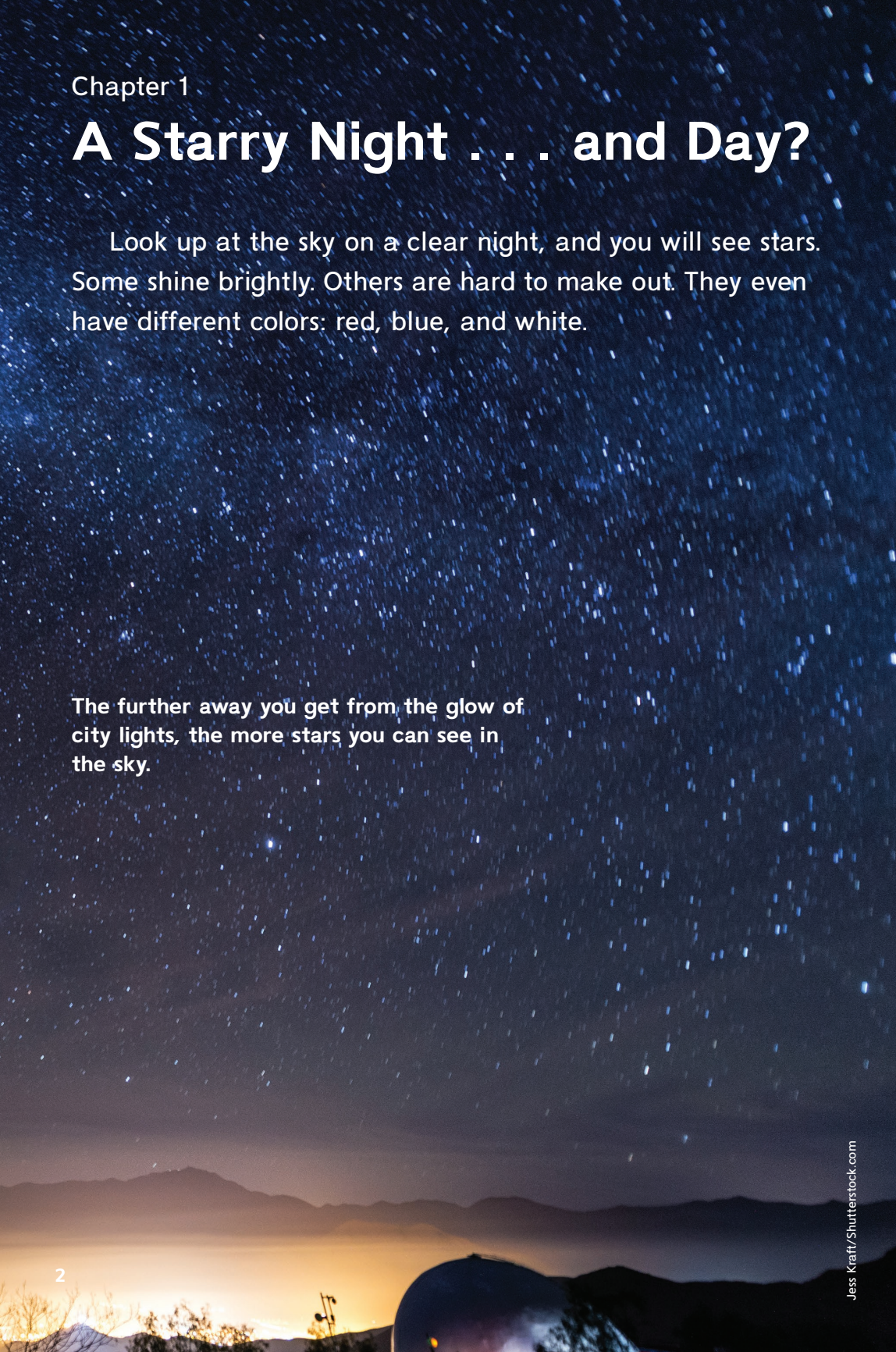
Chapter 1

A Starry Night . . . and Day?

Look up at the sky on a clear night, and you will see stars. Some shine brightly. Others are hard to make out. They even have different colors: red, blue, and white.



The further away you get from the glow of city lights, the more stars you can see in the sky.

Jess Kraft/Shutterstock.com

A **star** is a ball of hot gases, mostly hydrogen and helium. Inside a star, chemical reactions change hydrogen into helium. This produces great amounts of heat and light.

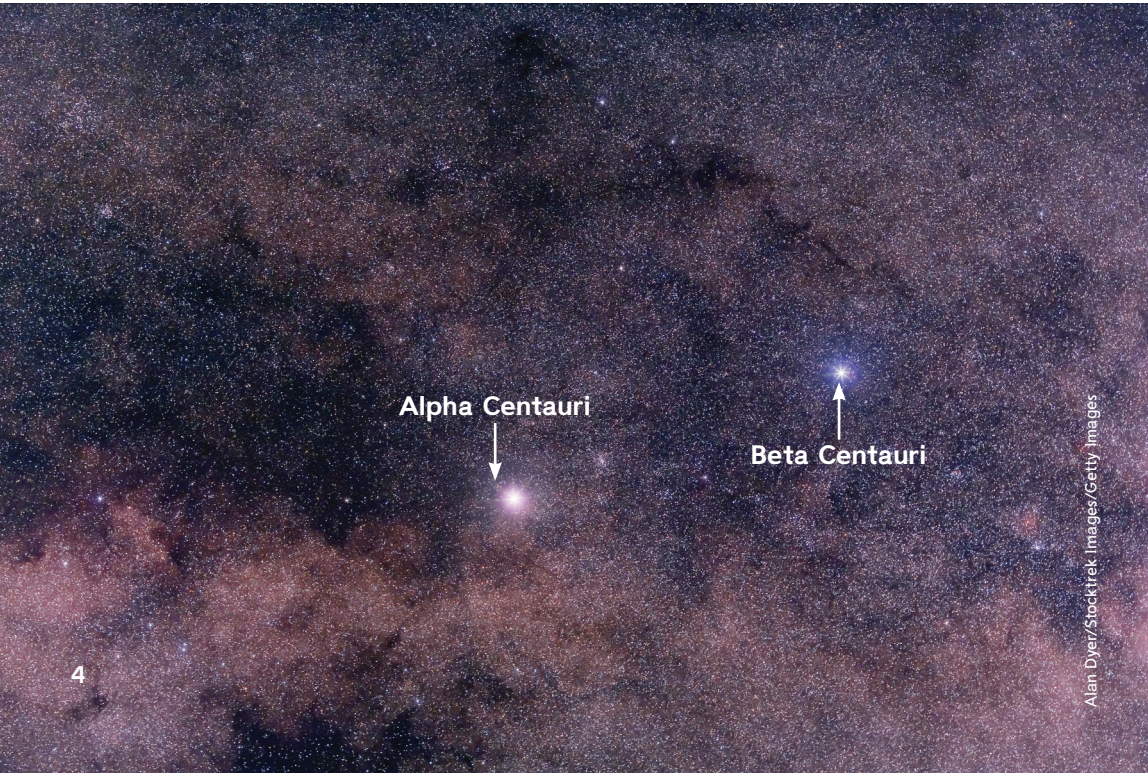
Heat and light leave a star's surface and travel through space.

R. O'Connell (University of Virginia), and the Hubble Heritage Team (STScI/AURA)/ESA/NASA

Astronomers use the speed of light to measure how far away things are in space. A **light-year** is the distance light travels in one year. Light travels at 300,000 kilometers (186,000 miles) per second. In one year, light travels almost 10 trillion kilometers (nearly 6 trillion miles). So that distance is one light-year.

The light from some stars can take thousands of light-years to reach Earth. When you look at the stars, you are looking back into time.

After the Sun, Alpha Centauri is the nearest star to Earth. It is about 40 trillion kilometers (25 trillion miles) away. The light from Alpha Centauri takes over 4 years to reach us.



Alan Dyer/Stocktrek Images/Getty Images

The stars we see at night look very small because they are so far away. They are actually much bigger than Earth.

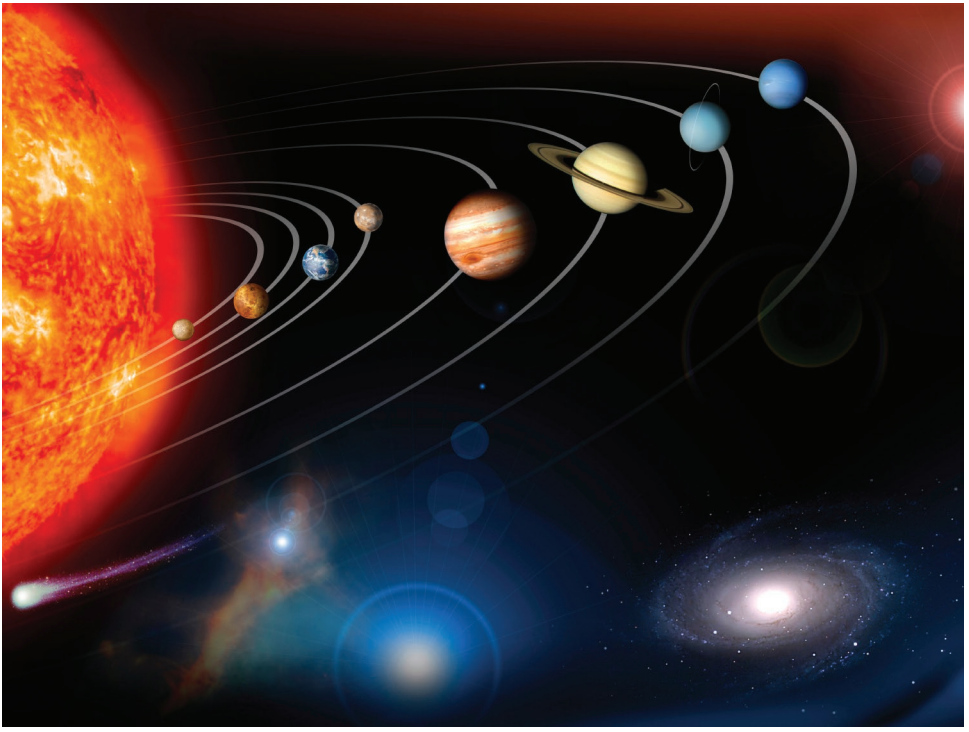
The Sun is the closest star to Earth. But it is not the biggest star in the universe. It only looks bigger than other stars because it is so close to Earth. Close objects look bigger than objects that are far away.

During the day, other stars are also in the sky. But we cannot see them because of the light from the Sun.

Jeff Whyte/Shutterstock.com

The **solar system** includes the Sun and everything that orbits it, including Earth. Our solar system is itself part of a **galaxy** called the Milky Way. A galaxy is a large group of stars.

Our solar system is located about 26,000 light-years away from the center of the Milky Way galaxy.



This is the Andromeda Galaxy.

About 5,000 stars are visible to the naked eye, but there are trillions of galaxies in the universe, each with billions of stars. Scientists believe the universe contains at least a septillion stars. That's a one followed by 24 zeroes. Which is . . . a lot of stars!

People who live in a city are surprised by how many stars they can see when they get away from town.

STOP AND CHECK

Why do you think astronomers use light-years to measure distance in space?

Fotosearch RF/Getty Images

Chapter 2

A Star's Life Cycle

Stars are born, grow old, and eventually die. Astronomers call this a star's *life cycle*. The entire life cycle of a star can be millions or even billions of years.

The long 'river' of stars you see in the sky is the Milky Way as seen from Earth.

vkbhat/E+/Getty Images

Stars are born in cold clouds of gas and dust called **nebulas**. Gravity causes the gases in nebulas to form into clumps. Chemical reactions inside the clumps change hydrogen into helium. Clumps begin to release heat and light. When the clumps grow hot enough, they become stars.

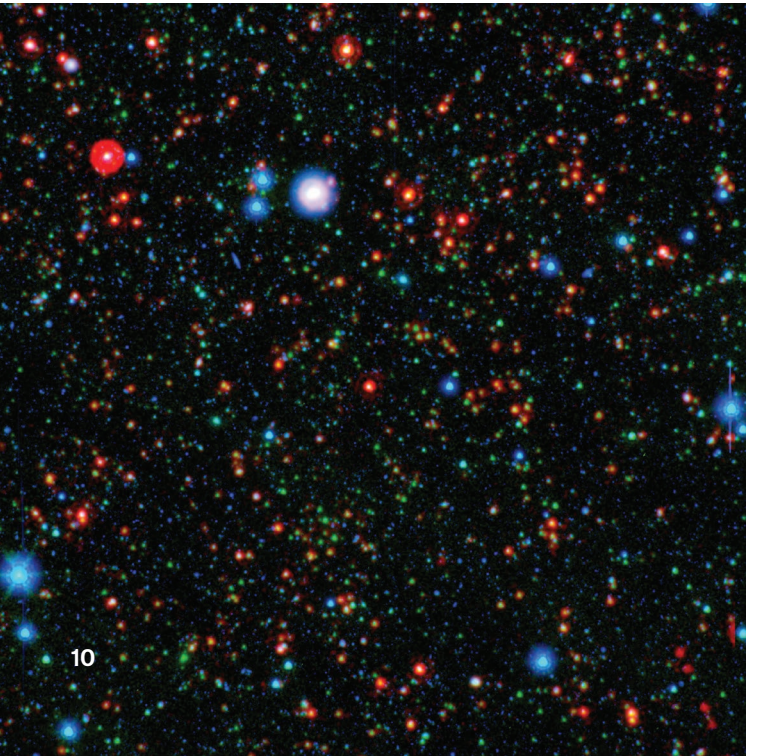
The Eagle Nebula has many 'pillars' of gas sticking out. The are known as the Pillars of Creation because stars are made here.

StockTrek/Getty Images

How long will a new star live? That depends on its size. Large stars burn fuel more quickly than smaller stars. They may live for only a few hundred thousand years. Smaller stars can live for billions of years. They use up their fuel much more slowly.

A star's color depends on its surface temperature. Bright, hot stars are blue-white. They are also much larger than our Sun. Dimmer, cooler stars are called red dwarves. They are too dim to be seen with the naked eye. Yellow stars like the Sun are medium-sized.

Color of star	Surface temperature
Red	2,500 Celsius/4,500 Fahrenheit
Yellow	5,500 Celsius/9,900 Fahrenheit
Blue-white	40,000 Celsius/72,000 Fahrenheit



The temperature of a star determines its color. These blue-white stars are much hotter than the red stars.

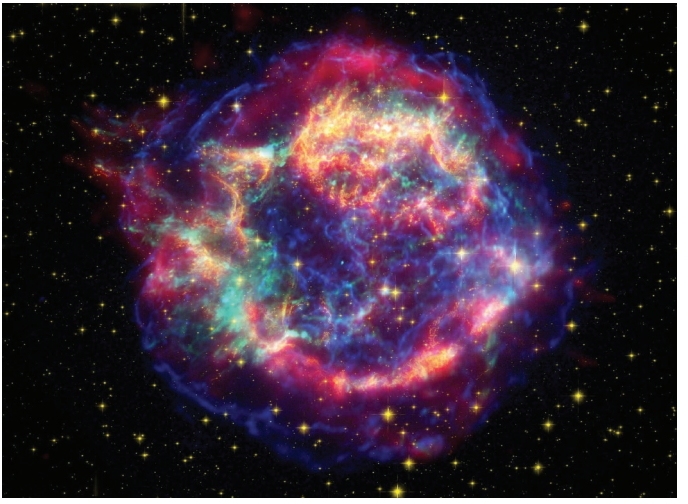
NASA/JPL-Caltech/Texas A&M

Eventually, a star will use all of its fuel. When this starts to happen, it will begin to expand and cool to become a red giant. What occurs next depends on the star's mass.

Smaller stars, like the Sun, will eventually become tiny white dwarf stars. Over time, they will cool and become invisible.

Large stars die suddenly. As they run out of fuel, they first expand into red supergiants. Then they blow apart in big explosion called a **supernova**. A supernova is brighter than any other star, but it fades within days. A tiny star called a neutron star is all that is left.

The largest stars form black holes after they explode. A black hole is a place in space where gravity pulls so much that even light cannot get out.



The supernova explosion of Cassiopeia A lit up the entire Milky Way.

NASA/JPL-Caltech/STScI/CXC/SAO

STOP AND CHECK

Where are new stars born?

Chapter 3

Crowded Skies

Not everything in the night sky is a star. If you know where to look, you can sometimes see a planet. Mercury, Venus, Mars, Jupiter, and Saturn are easy to find. Uranus can also occasionally be spotted by the naked eye. You need binoculars or a telescope to see Neptune.

Planets are usually a bright yellow because they reflect the sun's light. They are easier to track than stars, as they move across the sky.

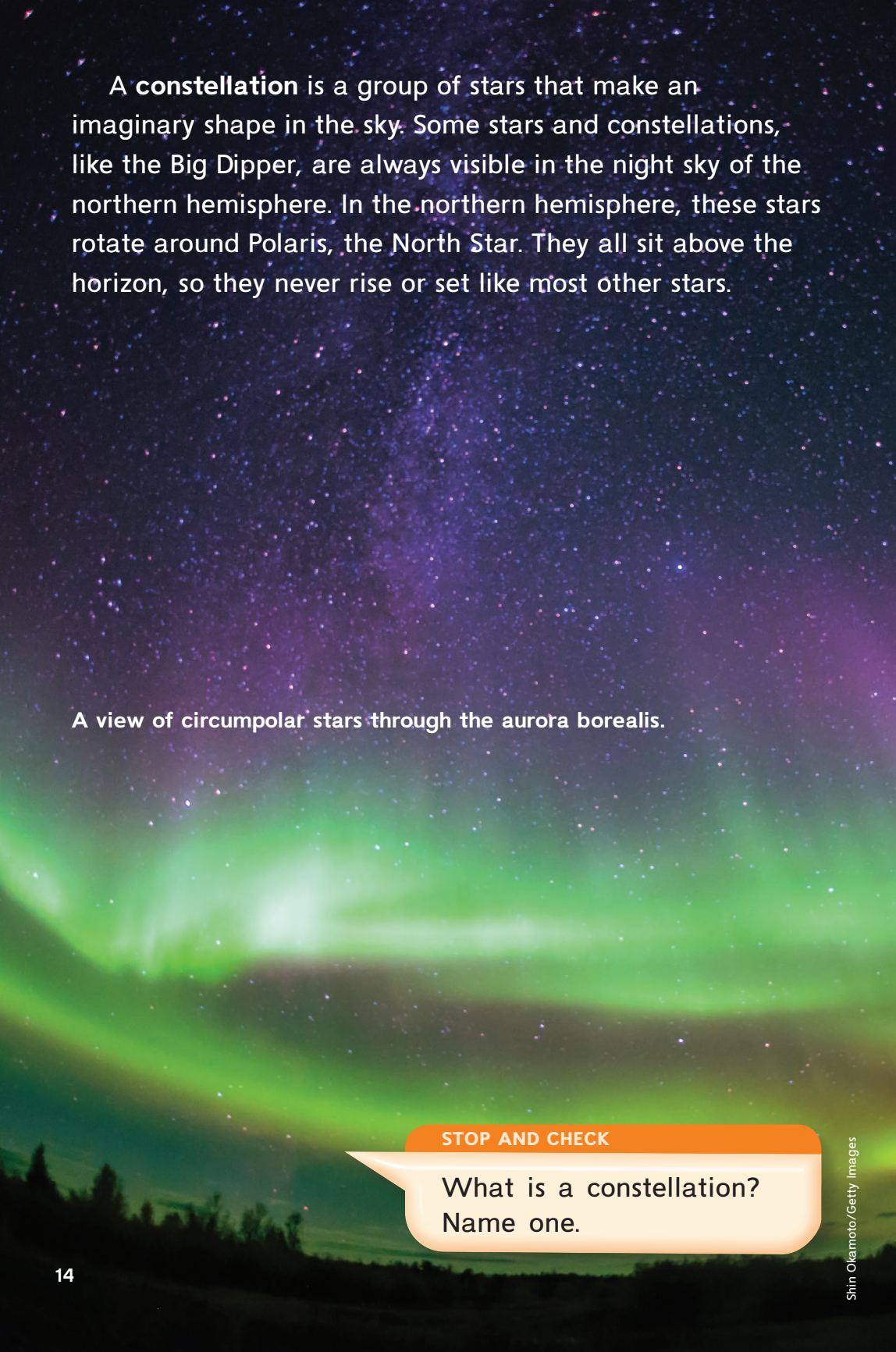
peresanz/Getty Images

It is also possible to see a nebula or a galaxy from Earth. The Orion Nebula, part of the constellation Orion, is a very bright nebula. New stars are being born there. In the northern hemisphere, the Andromeda Galaxy can sometimes be seen on dark, moonless nights.

Many stars are born in the Orion Nebula.

NASA

A **constellation** is a group of stars that make an imaginary shape in the sky. Some stars and constellations, like the Big Dipper, are always visible in the night sky of the northern hemisphere. In the northern hemisphere, these stars rotate around Polaris, the North Star. They all sit above the horizon, so they never rise or set like most other stars.



A view of circumpolar stars through the aurora borealis.

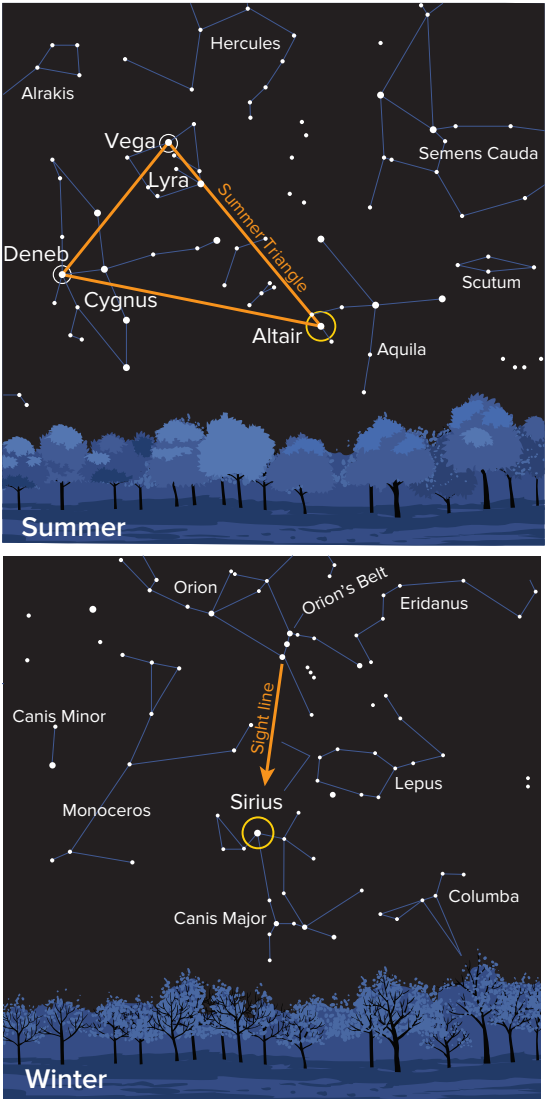
STOP AND CHECK

What is a constellation? Name one.

Shin Okamoto/Getty Images

Other stars and constellations appear in the sky at different times of the year. This is because the Earth orbits the Sun. We see different stars during different times of the year as Earth changes position around the Sun.

Many constellations can be seen only in the summer. Others are visible only in the winter.



Chapter 4

Unusual Stars

Stars are not all alike. They come in different sizes and colors. Sometimes they behave strangely.

For example, the constellation Orion contains a star called Rigel. Rigel is a binary star. A binary star is two stars that orbit each other. Rigel is a blue giant. Another star in Orion is called Betelgeuse, which is a giant red star.

Betelgeuse and Rigel very different kinds of stars, even though they are both part of the constellation Orion.

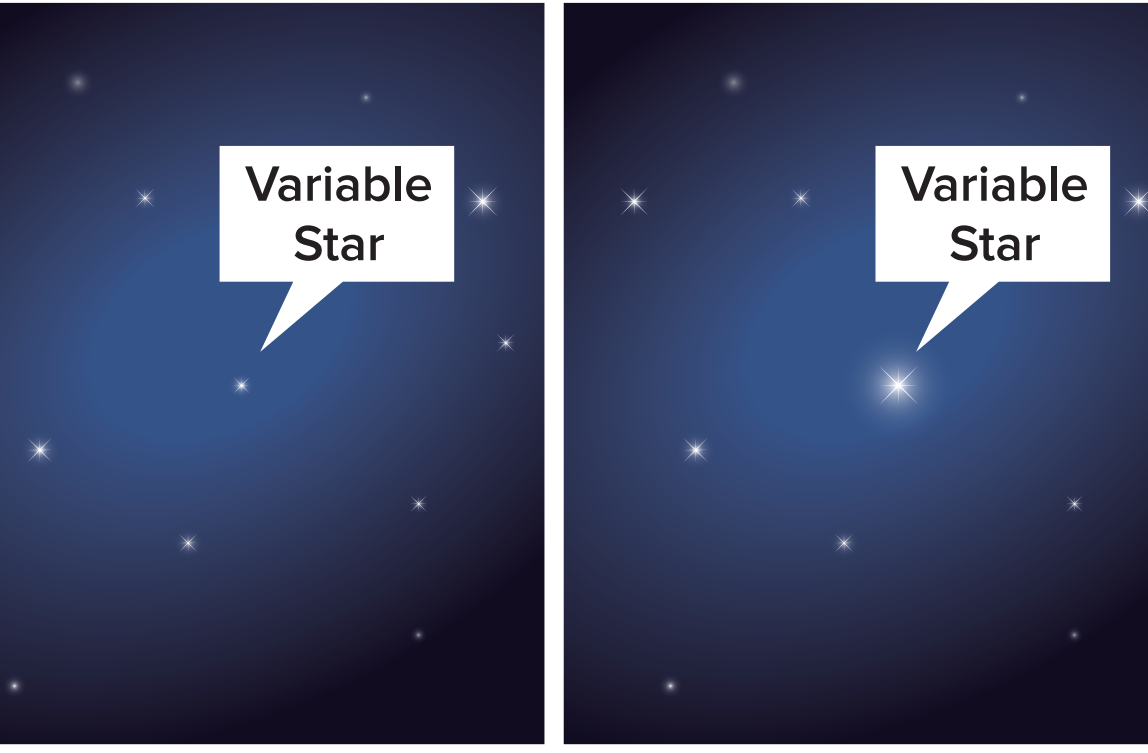
shyleen/123RF

A binary star is not the same as a double star. The term *double star* refers to a pair of stars that look close together in the sky. The stars Mizar and Alcor form a double star in the handle of the Big Dipper. Mizar is the second star from the end of the Big Dipper's handle. Alcor is its dim neighbor.

People with sharp vision can see the double star of Mizar and Alcor without a telescope.

Shaun Lowe/Getty Images

Stars that change brightness are called variable stars. Variable stars can change their brightness for many reasons. For example, sometimes one star in a binary pair passes in front of the other. The star dims when the neighboring star moves in front of it. It gets bright again when its neighbor moves out of the way.



Over 150,000 variable stars have been identified, and astronomers suspect there are many more.

A nova is a strong, rapid increase in the brightness of a star. Novas are caused when stars briefly re-ignite after being inactive for a long time. Novas usually fade from view after several weeks or months.

STOP AND CHECK

What is the difference between a binary star and a double star?

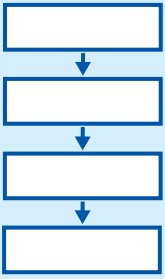
Discovered in December 2013, Nova Centauri 2013 was a bright nova in the constellation Centaurus.

NASA/MSFC/ESSSA/Aaron Kingery

Respond to Reading

Summarize

Use important details from Chapter 2, A Star's Life Cycle, to sequence the birth, life, and death of a star. Your graphic organizer may help you.



Text Evidence

1. Why does the Sun appear so much bigger in the sky than other stars?

2. Read the book again. Compare blue stars and red stars. How are they alike? How are they different? COMPARE AND CONTRAST

3. Why do large stars die more quickly than small stars? CAUSE AND EFFECT

4. What is the meaning of the word *hard* on page 2? What is another meaning for the word *hard*? What clues in the text show you which meaning to use on page 2? HOMOGRAPHS

5. Use the library and Internet to find out about a different kind of unusual star, like subdwarves or neutrons. Write a report about the object you select. What is it like? Include a main idea in your report and support it with key details. WRITE ABOUT READING

Genre Fiction

Compare Texts

Read about how a twin sister teachers her brother about stars.

Star Gazing

The twins zipped their jackets snugly as they stepped onto the back porch. It wasn't too cold for late November, though. Zane sighed as he looked up into the night sky. "The stars are so beautiful tonight," he whispered to his sister, Zeba.

"I think they're especially pretty when it's cold out," Zeba replied. She pointed toward the east. "Look! Orion is rising!"

"Umm . . . which one is Orion?" Zane laughed.

Zeba rolled her eyes. "Do you see that rectangle of four bright stars? That's Orion. He's called 'The Hunter.' The three stars in the middle are called 'Orion's Belt.' If you squint, you might see three smaller stars below —that's his sword."

As Zane looked at Orion, he asked, "Why do you like cold weather stars? How are they different from summer stars?"

"When it's winter, we get to see stars we can't see in the summer," Zeba answered. "Like Orion. He's not up there in the summer."

"Not there?" Zane questioned. "Where does he go?"

"Oh, brother!" Zeba rolled her eyes again. "Let's go get on the web. It's time you learn about seasonal stars."

Make Connections

Why is Orion visible in the winter sky but not the summer sky? TEXT TO TEXT

Glossary

constellation *(KON-steh-LAY-shun)* any of the patterns of stars that can be seen in the night sky from here on Earth *(page 14)*

galaxy *(GAL-eck-see)* a collection of billions of stars, dust, and gas that is held together by gravity *(page 6)*

light-year *(LYT YEER)* the distance light travels in one year (about 10 trillion kilometers or 6 trillion miles) *(page 4)*

nebula *(NEB-yoo-luh)* a giant cloud of gas and dust in space that glows from the light of stars inside them *(page 9)*

solar system *(SO-lurh SYS-tuhm)* the collection of planets, moons, and other objects that orbit the Sun *(page 6)*

star *(STAR)* an object in the sky that produces its own energy, including heat and light *(page 3)*

supernova *(SOO-per NO-vuh)* a large explosion that takes place at the end of a star's life cycle *(page 11)*

Index

Focus on Science

Purpose To show how light from the Sun makes it impossible to see constellations during the day.

Procedure

Step 1 Study the picture of the constellation Orion on page 16. Poke a hole in the bottom of a plastic or Styrofoam cup for each of the seven main stars in Orion.

Step 2 Go into a dark room with a blank wall. Place a flashlight into the cup and shine it on the wall. The constellation should appear as dots of light. (You may need to adjust the distance between the cup and the wall.)

Step 3 Leave your flashlight on, then turn on the room light to represent daytime.

Conclusion What happened to the constellation on the wall when you turned on the lights? What does the room light represent?

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