SC.5.E.5.1 Recognize that a galaxy consists of gas, dust, and many stars, including any objects orbiting the stars. Identify our home galaxy as the Milky Way.

LESSON 3

ESSENTIAL **QUESTION**

What Are Stars and Galaxies?

Engage Your Brain

Find the answer to the following question in this lesson and record it here.

Space is not completely empty. There are small particles in space. What happens when these particles come together?

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A nebula, such as the pelican nebula shown here, is a giant cloud of gas and dust.

ACTIVE **READING**

Lesson Vocabulary

List the terms. As you learn about each one, make notes in the Interactive Glossary.

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Signal Words: Details

Signal words show connections between ideas. *For example*, *for instance*, and *such as* signal examples of an idea. *Also* and *in fact* signal added facts. Active readers remember what they read because they are alert to signal words that identify examples and facts about a topic.

TWINKLING STARS

You see stars as tiny points of white light in the night sky. Stars are not tiny, and they are not all white. Find out how scientists study stars.

ACTIVE READING As you read these two pages, draw boxes around words or phrases that signal a detail or an added fact.

People have always looked at objects in the sky. **Astronomy** is the study of objects in space and their characteristics. *Astronomers* are scientists who study space and everything in it. They use many types of telescopes to observe objects in space, such as stars and planets.

Stars are huge balls of hot, glowing gases that produce their own heat and light. The sun is the star you know the most about. It seems much larger than other stars only because it is much closer to Earth.

DO THE MATH

Dividing by 3-digit Numbers

A small telescope magnifies objects 150 times. A large observatory telescope magnifies an object 3,300 times. How many times as great is the magnification of the observatory telescope than the small telescope?

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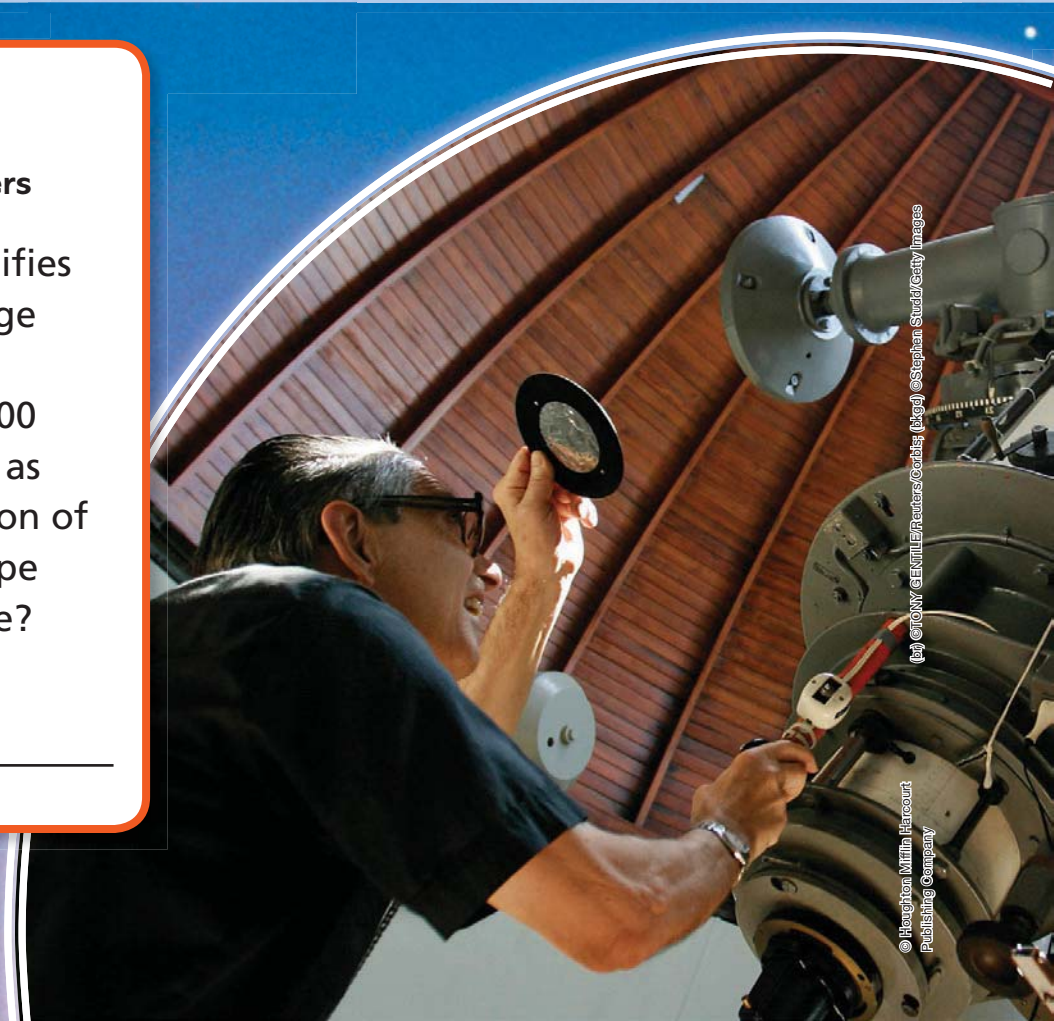


(t) ©TONY GENTILE/Reuters/Corbis; (bg) ©Stephan Studd/Getty Images

The sun is a medium-size yellow star. Many stars are larger or hotter than the sun. A supergiant, for example, can be more than 100 times the size of the sun.

A STAR IS BORN

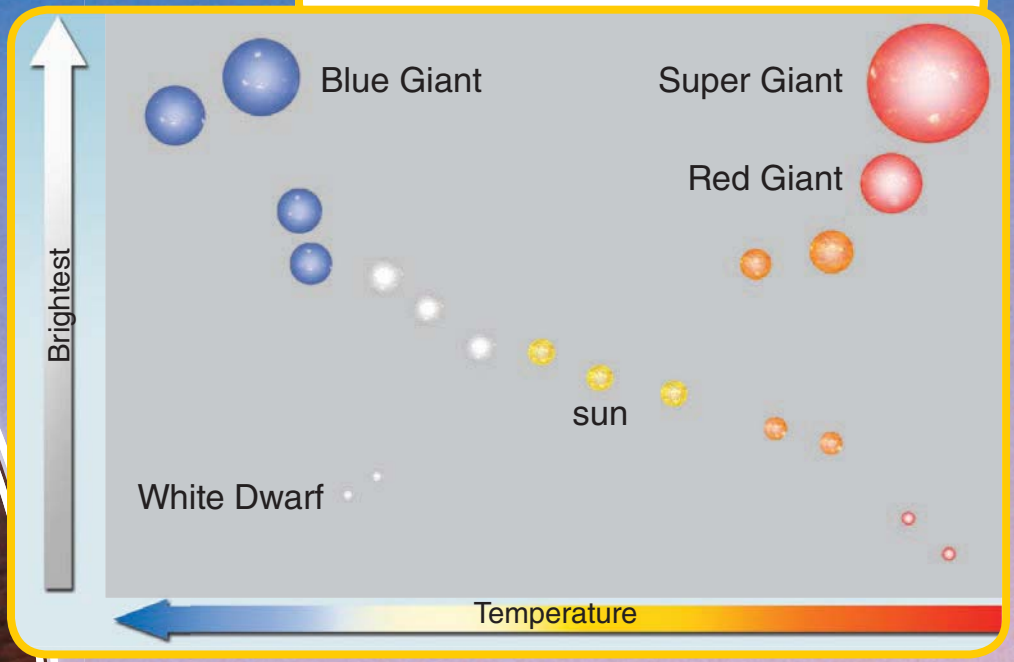
Stars form when gravity causes gas and dust particles found in space to pull together. These particles are squeezed together under great pressure. Eventually, energy stored in the particles is released as heat and light. A star is born.

Stars are classified by their color, temperature, brightness, and size. The color of a star can tell us about its temperature. For example, blue stars are the hottest. A blue star's average temperature is about 15,000 °C.

Stars have a wide range of sizes. White dwarf stars, for instance, can be as small as a planet. Giant and supergiant stars are many times bigger than the average-size star. The largest stars are also usually the brightest. A star's brightness is related to the amount of visible light it gives off.

Super Hot and Just Hot

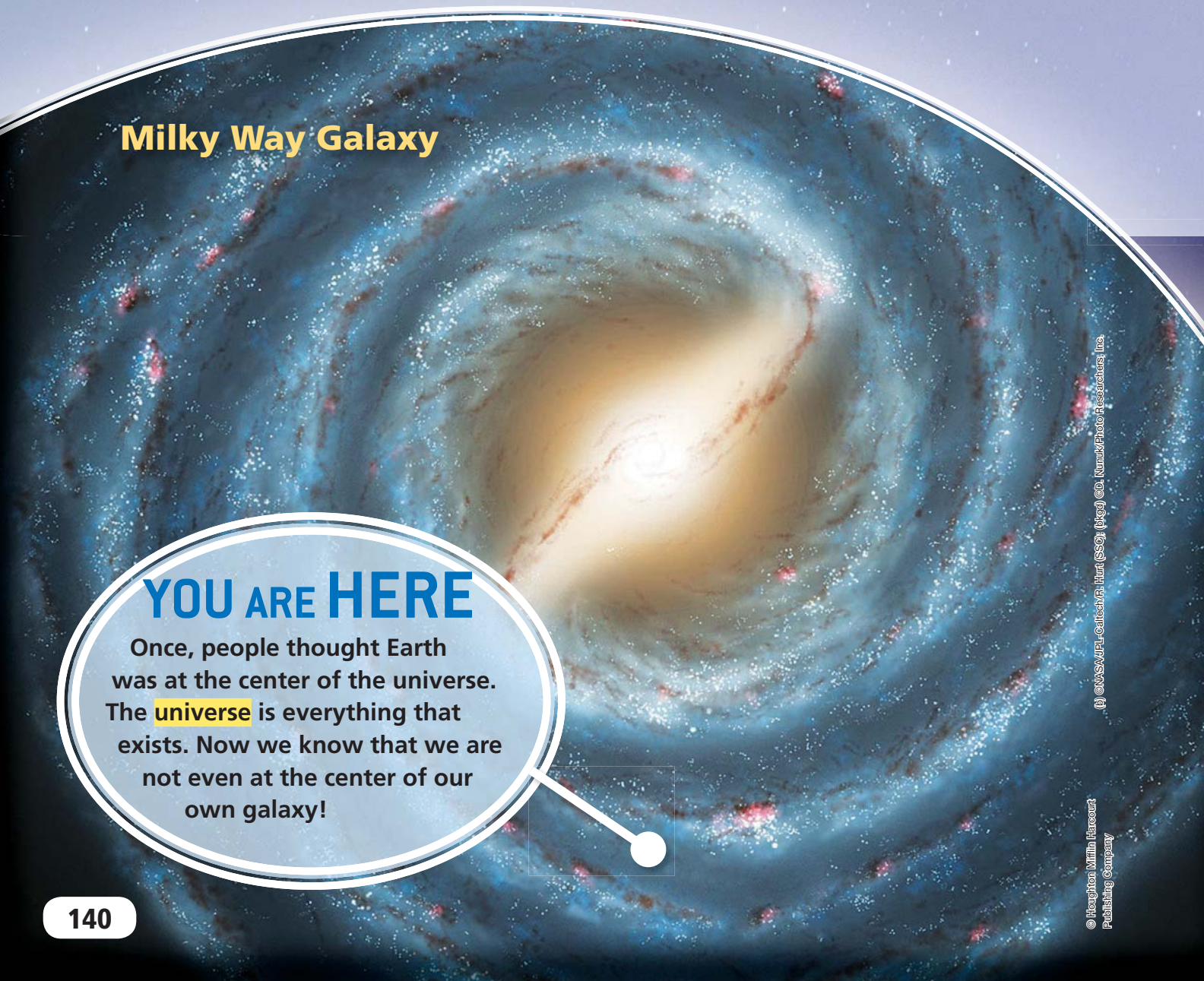
Draw a rectangle around the hottest stars in the diagram. Draw a circle around the brightest stars.



GOING GALACTIC

Our solar system is huge. Yet it is only a tiny part of a much larger system in space. Our sun is one star in a group of billions of stars found in the Milky Way galaxy.

ACTIVE READING As you read the next four pages, circle details about the ages of stars in each type of galaxy.



YOU ARE HERE

Once, people thought Earth was at the center of the universe. The universe is everything that exists. Now we know that we are not even at the center of our own galaxy!

▶ In the space below, describe the position of the solar system within the Milky Way.

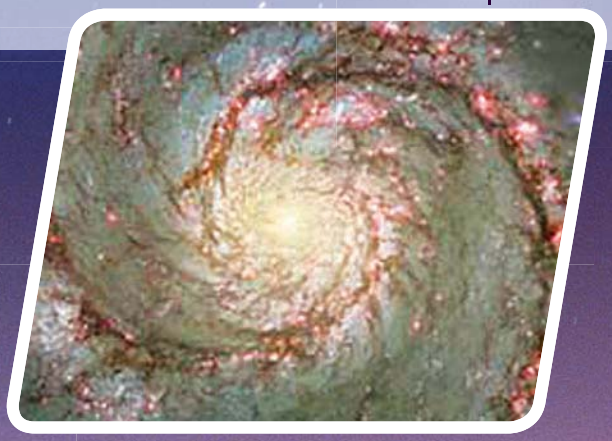
FEATURES OF GALAXIES

A **galaxy** is a group of billions of stars, the objects that orbit the stars, gas, and dust. A galaxy is held together by gravity. There are billions of galaxies in the universe. Galaxies are separated by large distances. On a cloudless night, you might see what looks like a faint band of clouds among the stars. This is a part of our home galaxy, the Milky Way. Most other galaxies can be seen only by using powerful telescopes.

TYPES OF GALAXIES

In the 1920s, astronomer Edwin Hubble was the first to study galaxies. He classified them by shape. Through his telescope, Hubble observed pinwheel-like groups of stars that he called *spiral galaxies*.

Some spiral galaxies, called *barred spiral galaxies*, have a center shaped like a long bar. Recent evidence suggests that the Milky Way is a barred spiral galaxy.



SPIRAL **GALAXIES**

Spiral galaxies consist of a rotating disk of young stars, gas, and dust and a central bulge made of older stars.

BARRED SPIRAL **GALAXIES**

Barred spiral galaxies may have two or more spiral arms. Unlike regular spirals, there are young stars at the center of barred spiral galaxies.

MORE TYPES OF GALAXIES

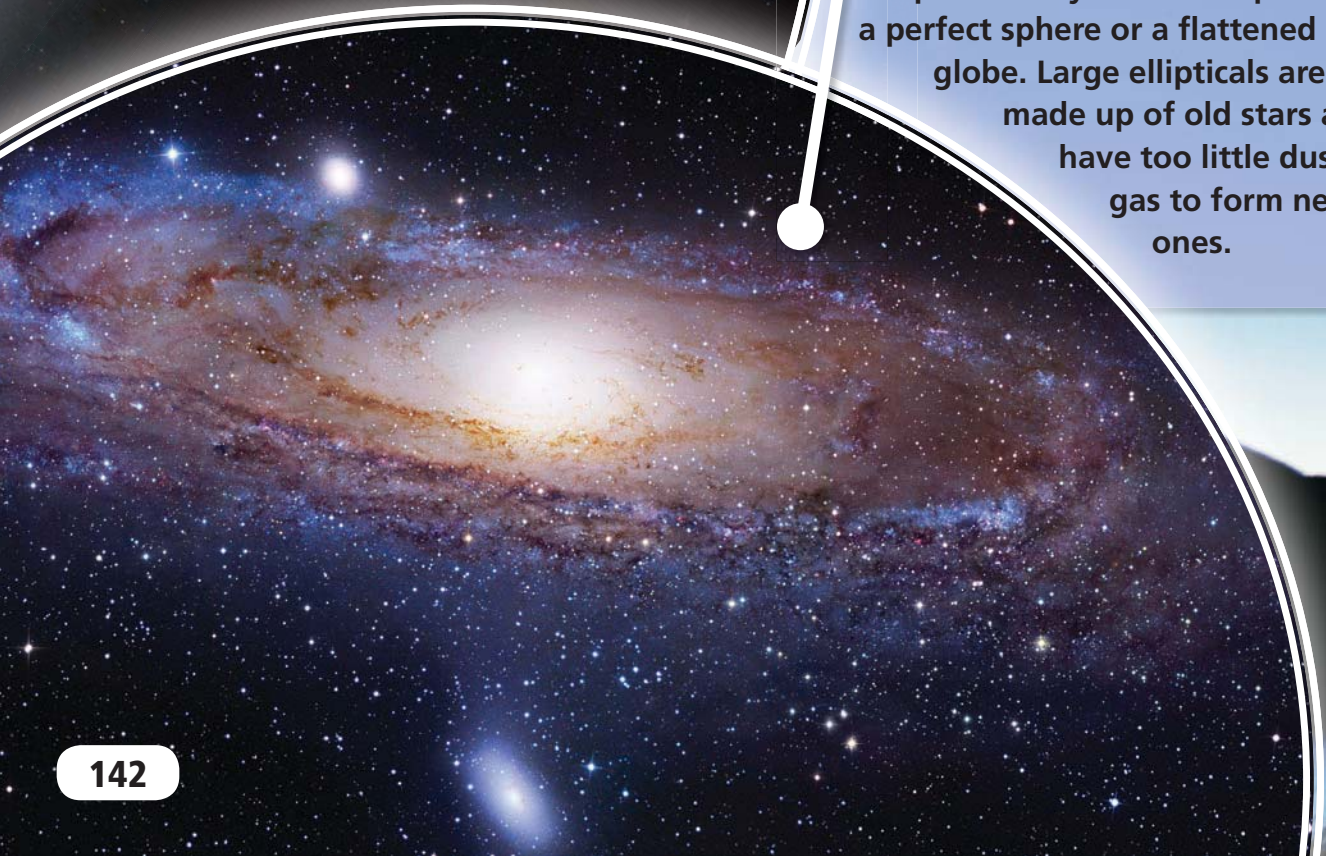
Most of the brightest galaxies in the universe have spiral shapes. But spiral galaxies are not the only type of galaxy. In fact, they make up only about 20 percent of all galaxies. The dimmer *irregular galaxies* and *elliptical galaxies* make up about 80 percent of all galaxies in the universe.

IRREGULAR **GALAXIES**

Irregular galaxies do not have any particular shape. The stars are randomly scattered. There is lots of gas and dust to form new stars. About 20 percent of all galaxies are irregular. Some astronomers think that gravity from nearby galaxies causes irregular galaxies to form.

ELLIPTICAL **GALAXIES**

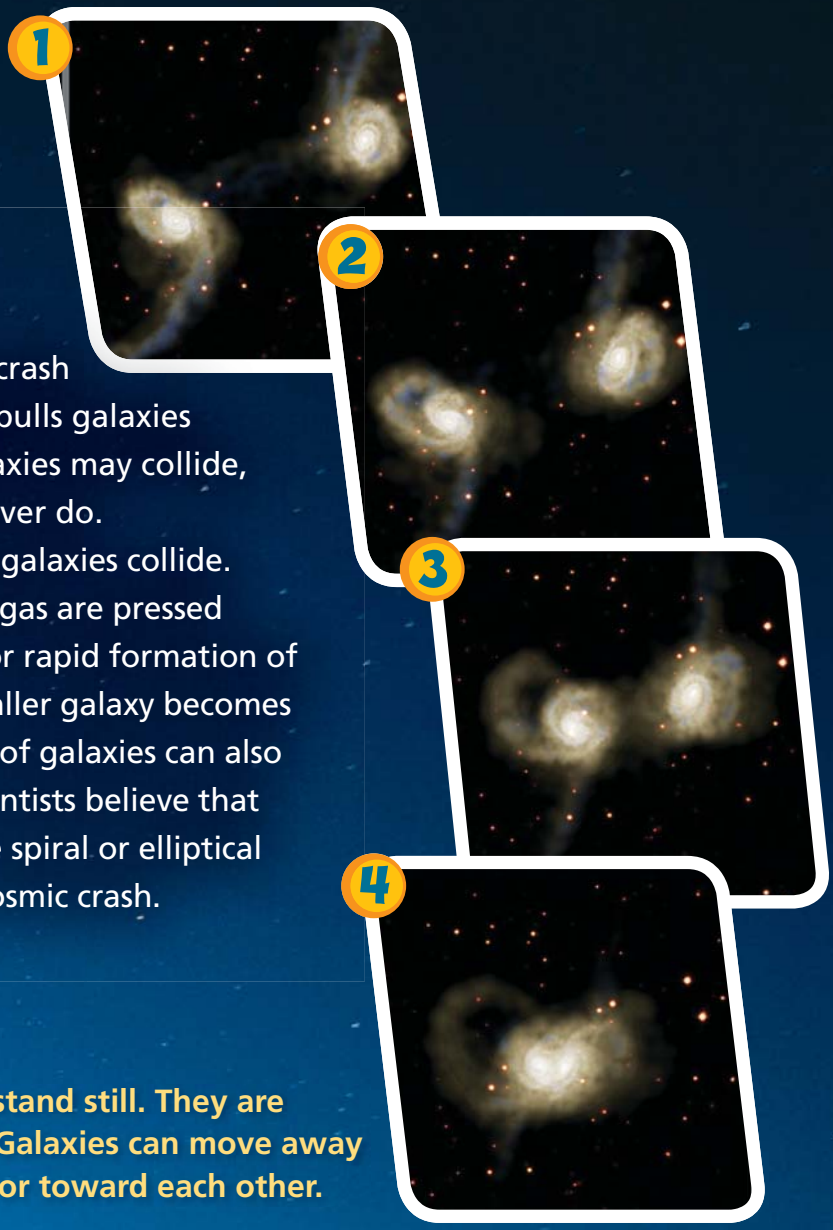
Elliptical galaxies are brightest at their center. About 60 percent of all galaxies in the universe are elliptical. They can be shaped like a perfect sphere or a flattened globe. Large ellipticals are made up of old stars and have too little dust or gas to form new ones.



COSMIC **CRASHES**

Sometimes galaxies collide, or crash together, in space! Why? Gravity pulls galaxies toward each other. Although galaxies may collide, single stars and planets almost never do.

Many things can happen when galaxies collide. Often, large amounts of dust and gas are pressed together. This causes a starburst, or rapid formation of many new stars. Sometimes, a smaller galaxy becomes part of a larger galaxy. A collision of galaxies can also form a large, irregular galaxy. Scientists believe that many irregular galaxies were once spiral or elliptical galaxies that were involved in a cosmic crash.



Galaxies do not stand still. They are always moving. Galaxies can move away from each other or toward each other.

▶ **Look at pictures 1–5. Draw a picture to show what you think will happen next to these two galaxies. Write a sentence to describe it.**

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