

**Stars, Galaxies, and the Universe** ▪ *Guided Reading and Study*

## Star Systems and Galaxies

*This section explains what a star system is, describes the three major types of galaxies, and describes the scale of the universe.*

### Use Target Reading Skills

*The first column in the chart lists key terms in this section. As you read the section, write a definition of the key term in your own words in the second column. Underline the most important feature or function in each definition. An example is done for you.*

Key Term	Definition
Binary star	Star system with <u>two stars</u> .
Eclipsing binary	
Open cluster	
Globular cluster	
Galaxy	
Spiral galaxy	
Elliptical galaxy	
Irregular galaxy	
Quasar	
Universe	
Scientific notation	

Stars, Galaxies, and the Universe

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**Star Systems and Galaxies** *(continued)*

**Star Systems and Clusters**

1. What are star systems?  
\_\_\_\_\_  
\_\_\_\_\_
2. Star systems with two stars are called double stars or \_\_\_\_\_.
3. How can astronomers tell whether there is an unseen second star in a system?
  - a. They observe the effects of its gravity on the brighter star.
  - b. They measure the parallax of the second star.
  - c. They send a probe to the second star.
  - d. They observe regular changes in the brightness of the star system.
4. A star system in which one star periodically blocks the light from another star is a(n) \_\_\_\_\_.
5. How did astronomers first discover a planet revolving around another star?  
\_\_\_\_\_  
\_\_\_\_\_
6. Why have most new planets discovered around other stars been very large?  
\_\_\_\_\_  
\_\_\_\_\_
7. A grouping of stars that has a loose, disorganized appearance and contains no more than a few thousand stars is called a(n) \_\_\_\_\_.
8. A large grouping of stars that contains mostly older stars is called a(n) \_\_\_\_\_.

**Galaxies**

9. What is a galaxy?  
\_\_\_\_\_  
\_\_\_\_\_

*Match the type of galaxy with its shape.*

Type of Galaxy	Description of Shape
___ 10. Spiral galaxy	a. Bulge in middle and arms that spiral outward
___ 11. Elliptical galaxy	b. Does not have a regular shape
___ 12. Irregular galaxy	c. Looks like round or flattened ball

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13. Circle the letter of each sentence that is true about galaxies.
- a. Elliptical galaxies contain only new stars.
  - b. Irregular galaxies usually have many bright, young stars.
  - c. In spiral galaxies, most new stars form in the spiral arms.
  - d. Quasars have huge bar-shaped regions of stars that pass through their center.
14. A young galaxy with a giant black hole at the center is a(n) \_\_\_\_\_.

**The Milky Way**

15. The galaxy in which our solar system is located is called the \_\_\_\_\_.
16. What type of galaxy is the Milky Way?
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

**The Scale of the Universe**

17. Why do astronomers often use scientific notation?
- \_\_\_\_\_
- \_\_\_\_\_
18. Suppose a star is about 38,000,000,000,000 kilometers away from Earth. How do you write this number in scientific notation?
- \_\_\_\_\_
- \_\_\_\_\_
19. What is the Local Group?
- \_\_\_\_\_
- \_\_\_\_\_
20. How large is the observable universe? \_\_\_\_\_

**Stars, Galaxies,  
and the Universe**

**Stars, Galaxies, and the Universe** ▪ *Section Summary*

# Star Systems and Galaxies

## Key Concepts

- What is a star system?
- What are the major types of galaxies?
- How do astronomers describe the scale of the universe?

Our solar system has only one star, the sun. **Most stars are members of groups of two or more stars, called star systems.** Star systems that have two stars are called double stars or **binary stars**. A system in which one star periodically blocks the light from another is called an **eclipsing binary**.

Astronomers have discovered more than 100 planets around other stars. Most of these new planets are very large. Some scientists think it is possible that life could be on planets in other solar systems. A few astronomers are using radio telescopes to search for signals that could not have come from natural sources.

Many stars belong to larger groups called star clusters. **Open clusters** have a loose, disorganized appearance and contain no more than a few thousand stars. **Globular clusters** are large groups of older stars. Some may contain more than a million stars.

A **galaxy** is a huge group of single stars, star systems, star clusters, dust, and gas bound together by gravity. **Astronomers classify most galaxies into the following types: spiral, elliptical, and irregular.** Galaxies that appear to have a bulge in the middle and arms that spiral outward, like pinwheels, are called **spiral galaxies**. **Elliptical galaxies** look like round or flattened balls. Galaxies that do not have regular shapes are known as **irregular galaxies**. **Quasars** are active young galaxies with giant black holes at their centers.

**Our solar system is located in a spiral galaxy called the Milky Way.** The Milky Way is usually thought of as a standard spiral galaxy. When you see the Milky Way at night during the summer, you are looking toward the center of our galaxy.

Astronomers define the **universe** as all of space and everything in it. **Since the numbers astronomers use are often very large or very small, they frequently use scientific notation to describe sizes and distances in the universe.** **Scientific notation** uses powers of ten to write very large or very small numbers in shorter form.

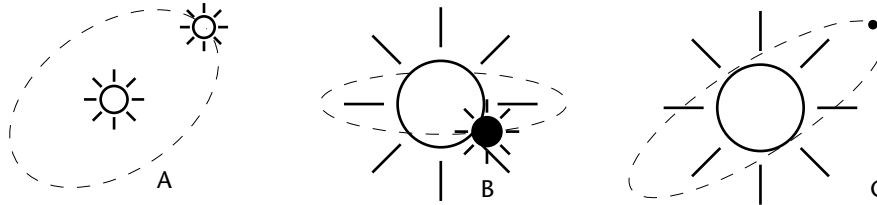
The structures in the universe vary greatly in scale. Beyond the solar system, the sizes of observable objects become much larger. Beyond our galaxy are billions of other galaxies, many which contain billions of stars. The Milky Way is a part of a cluster of 50 or so galaxies called the Local Group. The Local Group is part of the Virgo Supercluster, which contains hundreds of galaxies.

**Stars, Galaxies, and the Universe** ▪ *Review and Reinforce*

# Star Systems and Galaxies

## Understanding Main Ideas

The figure below shows three star systems as they might be seen from Earth. Ellipses indicate orbits. Answer the questions in the spaces provided.



1. Which star system is an eclipsing binary? \_\_\_\_\_
2. The dim, tiny, but high-mass star in C is not visible from Earth. How could astronomers infer that it exists? \_\_\_\_\_

## Building Vocabulary

Write a definition for each of the following terms on the lines below.

3. binary star \_\_\_\_\_  
\_\_\_\_\_
4. eclipsing binary \_\_\_\_\_  
\_\_\_\_\_
5. open cluster \_\_\_\_\_  
\_\_\_\_\_
6. globular cluster \_\_\_\_\_  
\_\_\_\_\_
7. spiral galaxy \_\_\_\_\_  
\_\_\_\_\_
8. elliptical galaxy \_\_\_\_\_  
\_\_\_\_\_
9. irregular galaxy \_\_\_\_\_  
\_\_\_\_\_
10. quasar \_\_\_\_\_  
\_\_\_\_\_
11. universe \_\_\_\_\_  
\_\_\_\_\_
12. scientific notation \_\_\_\_\_  
\_\_\_\_\_

**Stars, Galaxies, and the Universe** ▪ *Enrich*

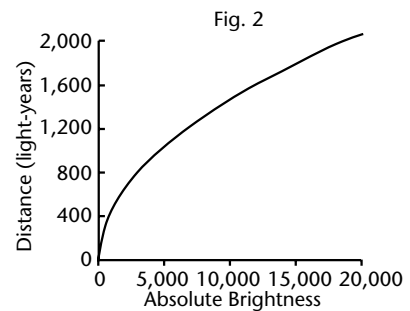
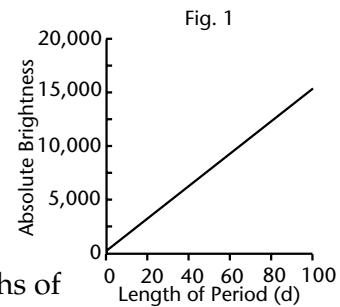
## Distances to the Galaxies

For nearly 100 years after galaxies were first seen with telescopes, astronomers didn't know what they were. At first, they were thought to be small nearby objects. Astronomers can use parallax to measure the distance to objects up to a few hundred light-years away. Galaxies were too far away to be measured by parallax. In 1923, the astronomer Edwin Hubble solved the problem by using a class of stars called variable stars. These unusual stars become brighter and dimmer in repeating cycles of 1 to 100 days.

By examining variable stars whose distance from the sun was determined by parallax, astronomers had discovered a useful relationship between the length of their brightness/dimness cycles and their average absolute brightness. Usually, to figure out a star's absolute brightness, you have to know both its apparent brightness and its distance from Earth. With a variable star, if you know the time period of its brightness/dimness cycle, you can calculate its absolute brightness. Then, comparing its absolute brightness with its apparent brightness, you can calculate its distance, even if it is much farther than 1,000 light-years away.

Hubble identified some faint variable stars in photographs of the Andromeda galaxy. Using these, he calculated that the Andromeda galaxy and other galaxies were millions of light-years away and very large.

Suppose astronomers discover the five variable stars in the table. Use the graph in Figure 1 to estimate their absolute brightness. All five have an average apparent brightness of 5. For variable stars with this apparent brightness, you can use the graph in Figure 2 to determine each star's distance from Earth.



	<b>Length of bright/ dim cycle (days)</b>	<b>Absolute brightness (sun = 1)</b>	<b>Distance (light-years)</b>
Variable star A	5		
Variable star B	20		
Variable star C	35		
Variable star D	50		
Variable star E	90		

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