# Study Guide

Interactive Textbook
- Complete student edition
- Section and chapter self-assessments
- Assessment reports for teachers

## Help Students Read

### *Building Vocabulary*

**Paraphrase** Ask students to write the vocabulary words on a separate sheet of paper. Instruct students to write a definition in their own words for each term. Have each student write a complete sentence using the term after writing the definition.

**Plural Forms** Have students use dictionaries to look up the plural forms of the words *nebula (nebulae* or *nebulas)* and *supernova (supernovae* or *supernovas)*. Students also can study the Latin meanings of the words. *(*Nebula *means "cloud" and* nova *means "new star.")*

## Connecting Concepts

**Concept Maps** Help students develop a concept map to show how the information in this chapter is related. Stars are classified by their physical characteristics; depending on their mass, stars progress through a consistent series of stages in their life cycles, and are part of galaxies, which are likely to continue to move farther apart as the universe expands. Have students brainstorm to identify the key concepts, key terms, details, and examples. Then have students write these items on self-stick notes and attach them at random on chart paper or on the board.

Tell students that this concept map will be organized in hierarchical order, so they will begin by placing the key concepts at the top. Ask students these questions to guide them to categorize the information on the stickies: **How are stars classified? What are the stages of a star? How are stars grouped?**

Prompt students by using such connecting words or phrases as "consists of," "to form," and "belong to" to indicate the basis for the organization of the map. The phrases should form a sentence between or among a set of concepts.

**Answer** Accept all logical presentations.

# Chapter Study Guide

## 1 Telescopes

**Key Concepts**

- The electromagnetic spectrum includes radio waves, infrared radiation, visible light, ultraviolet radiation, X-rays, and gamma rays.
- Telescopes are instruments that collect and focus light and other forms of electromagnetic radiation.
- Many large observatories are located on mountaintops or in space.

**Key Terms**

- telescope
- visible light
- wavelength
- spectrum
- optical telescope
- electromagnetic radiation
- refracting telescope
- convex lens
- reflecting telescope
- radio telescope
- observatory

## 2 Characteristics of Stars

**Key Concepts**

- Characteristics used to classify stars include color, temperature, size, composition, and brightness.
- The brightness of a star depends upon both its size and temperature.
- Astronomers use a unit called the light-year to measure distances between the stars.
- Astronomers often use parallax to measure distances to nearby stars.
- Astronomers use H-R diagrams to classify stars and to understand how stars change over time.

**Key Terms**

- constellation • spectrograph
- apparent brightness • absolute brightness
- light-year • parallax
- Hertzsprung-Russell diagram
- main sequence

## 3 Lives of Stars

**Key Concepts**

- A star is born when the contracting gas and dust from a nebula become so dense and hot that nuclear fusion starts.
- How long a star lives depends on its mass.
- After a star runs out of fuel, it becomes a white dwarf, a neutron star, or a black hole.

**Key Terms**

- nebula • protostar • white dwarf
- supernova • neutron star • pulsar
- black hole

## 4 Star Systems and Galaxies

**Key Concepts**

- Most stars are members of groups of two or more stars called star systems.
- Astronomers classify most galaxies into the following types: spiral, elliptical, and irregular.
- Our solar system is located in a spiral galaxy called the Milky Way.
- Astronomers often use scientific notation to describe sizes and distances in the universe.

**Key Terms**

- binary star • eclipsing binary • open cluster
- globular cluster • galaxy • spiral galaxy
- elliptical galaxy • irregular galaxy
- quasar • universe • scientific notation

## 5 The Expanding Universe

**Key Concepts**

- According to the big bang theory, the universe formed in an instant, billions of years ago, in an enormous explosion.
- About five billion years ago, a giant cloud of gas and dust collapsed to form our solar system.
- New observations lead astronomers to conclude that the universe will likely expand forever.

**Key Terms**

- big bang • Hubble's law
- cosmic background radiation • solar nebula
- planetesimal • dark matter • dark energy

### All in One Teaching Resources

- Key Terms Review: *Stars, Galaxies, and the Universe*
- Connecting Concepts: *Stars, Galaxies, and the Universe*

# Review and Assessment

Go Online PHSchool.com
For: Self-Assessment
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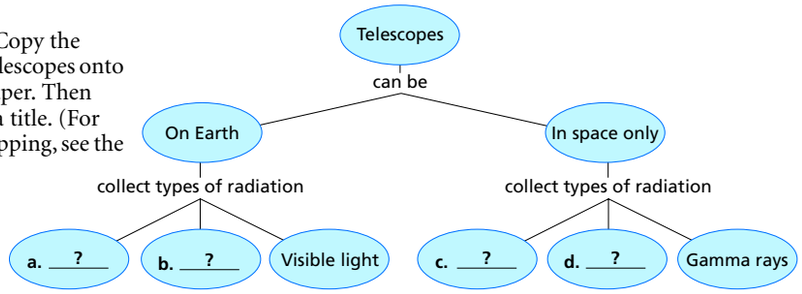
Web Code: cfa-5040

## Organizing Information

**Concept Mapping** Copy the concept map about telescopes onto a separate sheet of paper. Then complete it and add a title. (For more on Concept Mapping, see the Skills Handbook.)




## Reviewing Key Terms

**Choose the letter of the best answer.**

1. Visible light is a form of
   **a.** spectrum.
   **b.** electromagnetic radiation.
   **c.** wavelength.
   **d.** cosmic background radiation.
2. An H-R diagram is a graph of stars' temperature and
   **a.** apparent brightness.
   **b.** main sequence.
   **c.** absolute brightness.
   **d.** parallax.
3. A low-mass main sequence star will eventually evolve into a
   **a.** white dwarf. **b.** protostar.
   **c.** black hole. **d.** nebula.
4. A star system in which one star blocks the light from another is called a(n)
   **a.** open cluster.
   **b.** quasar.
   **c.** binary star.
   **d.** eclipsing binary.
5. Astronomers theorize that the universe began in an enormous explosion called the
   **a.** solar nebula.
   **b.** supernova.
   **c.** big bang.
   **d.** big crunch.

**If the statement is true, write *true*. If it is false, change the underlined word or words to make the statement true.**

6. A reflecting telescope uses convex lenses to gather and focus light.
7. Astronomers use spectrographs to determine the chemical composition of stars.
8. Pulsars are a kind of neutron star.
9. A galaxy shaped like a ball and containing only older stars is most likely a spiral galaxy.
10. Globular clusters are small asteroid-like bodies that formed the building blocks of the planets.

## Writing in Science

**News Article** Imagine that you are a journalist covering current research in astronomy, including stars and black holes. Write an article explaining what black holes are, how they form, and how they can be detected.

Discovery CHANNEL SCHOOL
*Stars, Galaxies, and the Universe*
Video Preview
Video Field Trip
Video Assessment

Go Online PHSchool.com
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Students can take an online practice test that is automatically scored.

**All in One Teaching Resources**

- Transparency J48
- Chapter Test
- Performance Assessment Teacher Notes
- Performance Assessment Teacher Worksheet
- Performance Assessment Scoring Rubric

***ExamView*® Computer Test Bank CD-ROM**

# Review and Assessment

## Organizing Information

**a.** radio waves
**b.** infrared
**c.** ultraviolet
**d.** X-rays

## Reviewing Key Terms

**1.** b **2.** c **3.** a **4.** d **5.** c
**6.** refracting telescope
**7.** true
**8.** true
**9.** elliptical galaxy
**10.** Planetesimals

## Writing in Science

**Writing Skill** Research

**Scoring Rubric**

**4** Exceeds criteria by including accurate information presented in an interesting manner
**3** Meets criteria by including accurate information, but presentation is not interesting
**2** Includes only basic information about what a black hole is, how it forms, or how it is detected
**1** Is inaccurate and incomplete

Discovery CHANNEL SCHOOL Video Assessment

### *Stars, Galaxies, and the Universe*

Show the Video Assessment to review chapter content and as a prompt for the writing assignment. Discussion questions: **How are a star's mass and its lifespan related?** *(More massive stars have shorter lifespans.)* **Explain what can happen when a star dies.** *(How a star dies depends on its mass. If a star is massive enough, it can form a neutron star or a black hole. Gravity causes what remains after the star explodes to collapse. If the mass of the star is similar to or smaller than that of the sun, it will eventually become a white dwarf.)*

## Checking Concepts

**11.** A light-year is a unit of distance. It measures how far light travels in one year.

**12.** The distance that a star so far away would appear to move when seen from opposite sides of Earth's orbit would be too small to measure accurately.

**13.** A star is born when nuclear fusion begins.

**14.** Most star formation takes place in the spiral arms of our galaxy.

**15.** Hubble's law states that the farther away a galaxy is, the faster it is moving away from us.

**16.** Its presence can be inferred by observing the effect of its gravity on visible objects, such as stars, or on light.

## Math Practice

**17.** Spica is about $2.5 \times 10^{15}$ kilometers from our solar system.

**18.** The star Antares is $6.04 \times 10^{2}$ light-years from Earth.

# Review and Assessment

### Checking Concepts

**11.** Is a light-year a unit of distance or a unit of time? Explain.

**12.** Why can't astronomers measure the parallax of a star that is a million light-years away?

**13.** At what point in the evolution of a star is the star actually born?

**14.** Where in our galaxy does most star formation take place?

**15.** What is Hubble's law?

**16.** How can astronomers detect dark matter if they cannot observe it directly?

### Math Practice

**17. Calculating** The bright star Spica is 262 light-years from our solar system. How many kilometers is this?

**18. Scientific Notation** The star Antares is approximately 604 light-years from Earth. Write this distance in scientific notation.

### Thinking Critically

**19. Inferring** What advantage might there be to locating a telescope, such as the one shown below, on the moon?

**20. Applying Concepts** Describe a real-world situation involving absolute and apparent brightness. (*Hint:* Think about riding in a car at night.)

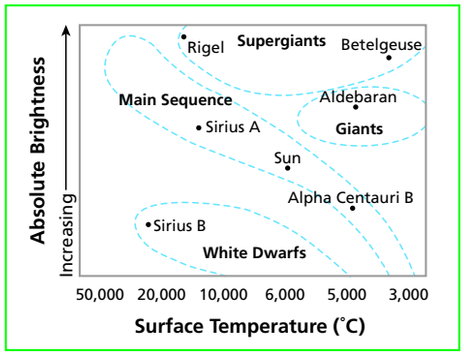
**21. Relating Cause and Effect** How does a star's mass affect its lifetime?

**22. Comparing and Contrasting** Compare the conditions that led to the formation of the terrestrial planets with those that led to the formation of the gas giants.

### Applying Skills

**Use the data in the H-R diagram below to answer Questions 23–26.**

**Hertzsprung-Russell Diagram**




**23. Interpreting Diagrams** Which star has a greater absolute brightness, Aldebaran or Sirius B?

**24. Interpreting Diagrams** Which stars have higher surface temperatures than Sirius A?

**25. Applying Concepts** Which star is most likely to be red: Rigel, Sirius B, or Betelgeuse?

**26. Comparing and Contrasting** Compare Aldebaran and the sun in terms of size, temperature, and absolute brightness.

### Lab zone Chapter Project

**Performance Assessment** Check the final draft of your constellation story for correct spelling, grammar, punctuation, and usage. Then decide how you will present your story. For example, you could make a poster, read your story aloud, or perform it as a skit or a play.

### Lab zone Chapter Project

L3

**Performance Assessment** Advise students to be ready to answer questions from you and from other students about the classical myths associated with their constellations. Encourage students who have studied the same constellation to compare their different approaches to writing new stories for it.

Encourage students to reflect on the research and writing process. Ask students to identify points on which they spent too much time, as well as points on which they spent too little time. Have students make suggestions on how they would improve their projects.

# Standardized Test Prep

### Test-Taking Tip

**Sequencing Events**

Some questions ask you to arrange a series of events in order. For example, you might be asked which event comes first or last, or which event comes before another event. Before looking at the answer choices, first try to recall the sequence of events in the entire process. If you have an idea of the sequence beforehand, you should find it easier to identify the correct answer.

***Sample Question***

Which of the following correctly describes the evolution of a sun-like star from young to old?

**A** white dwarf, red giant, main-sequence star, protostar
**B** red giant, main-sequence star, white dwarf, protostar
**C** protostar, main-sequence star, white dwarf, red giant
**D** protostar, main-sequence star, red giant, white dwarf

***Answer***

The correct answer is **D**. Choice **A** gives the correct order from old to young, rather than young to old. Choices **B** and **C** do not correctly sequence the life cycle of any star.

**Choose the letter of the best answer.**

**1.** The most common chemical element in most stars is
**A** oxygen.
**B** hydrogen
**C** helium.
**D** nitrogen.

**2.** The main factor that affects the evolution of a star is its
**F** color.
**G** apparent brightness.
**H** mass.
**J** parallax.

**3.** The color of a star is related to its temperature. Which of the following color sequences correctly identifies the temperatures of stars in order from hottest to coldest?
**A** red, red-orange, yellow, white, blue
**B** yellow, white, blue, red, red-orange
**C** blue, yellow, red-orange, red, white
**D** blue, white, yellow, red-orange, red

*The table below gives an estimate of the distribution of stars in the Milky Way galaxy. Use the table and your knowledge of science to answer Questions 4 and 5.*

| Type of Star | Percentage of Total |
|---|---|
| Main sequence | 90.75% |
| Red Giant | 0.50% |
| Supergiant | < 0.0001% |
| White Dwarf | 8.75% |

**4.** According to the table, the most common type of stars in the Milky Way is
**F** main-sequence stars.
**G** red giants.
**H** supergiants.
**J** white dwarfs.

**5.** If there are a total of 400 billion stars in the Milky Way, about how many white dwarfs are there in the galaxy?
**A** 8.75 billion
**B** 35 billion
**C** 87.5 billion
**D** 3,500 billion

### Constructed Response

**6.** Describe the appearance of the Milky Way as you would see it both from Earth and from a point directly above or below the galaxy. Why does the galaxy look different from different vantage points?

## Thinking Critically

**19.** The moon has no atmosphere that could distort telescope images.

**20.** High beams on car headlights have a greater absolute magnitude than low beams do. Also, the closer an oncoming car is to you, the greater the apparent brightness of its headlights (on low or high).

**21.** Low-mass stars have longer lifetimes than do high-mass stars because low-mass stars burn their fuel much more slowly.

**22.** Because of high temperatures in the inner solar system, most gases escaped the gravity of planets forming in this region, causing the inner planets to be rocky. The outer solar system, being farther from the sun, was cooler. As a result, planets forming in this region were able to capture gases and so became gas giants.

## Applying Skills

**23.** Aldebaran has a greater absolute brightness.

**24.** Rigel and Sirius B have higher surface temperatures than Sirius A.

**25.** Betelgeuse is most likely to be red.

**26.** The sun is a medium-sized star with average absolute brightness and a surface temperature of about 5,800°C. Aldebaran is a giant with a high absolute brightness and a surface temperature of about 4,000°C.

## Standardized Test Prep

**1.** B **2.** H **3.** D **4.** F **5.** B

**6.** From Earth, the Milky Way looks like a thick ribbon of stars across the night sky. This is because we are looking at it from one of its arms, so it is like looking at the edge of a dinner plate. From above and below, the Milky Way would look like a disc or a spiral because you would be outside of it and able to see the entire galaxy.