

Stars, Galaxies, and the Universe ▪ *Reading/Notetaking Guide***Telescopes** (pp. 590–596)

This section describes electromagnetic radiation. It also explains how different types of telescopes work and where they are located.

Use Target Reading Skills

The first column in the chart lists key terms in this section. Write what you know about the key term in the second column. As you read, write a definition of the key term in your own words in the third column. An example is done for you.

Key Term	What You Know	Definition
Electromagnetic radiation	You can see only some types of it.	Energy that can move through space in the form of waves
Visible light		
Wavelength		
Spectrum		
Optical telescope		
Refracting telescope		
Convex lens		
Reflecting telescope		
Radio telescope		
Observatory		

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Electromagnetic Radiation (p. 591)

1. What is electromagnetic radiation?

2. The light you see with your eyes is called _____.

3. The distance between the crest of one wave and the crest of the next wave is called a(n) _____.

4. A range of light of different colors and different wavelengths is called a(n) _____.

5. What colors form the spectrum of visible light?

6. What wavelengths are included in the electromagnetic spectrum?

Types of Telescopes (pp. 592–593)

7. What do telescopes collect and focus?

8. What is a convex lens?

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Telescopes *(continued)*

9. Complete the table to compare and contrast different types of telescopes.

Telescopes	
Type	Description
Refracting telescope	a.
Reflecting telescope	b.
Radio telescope	c.

- d. How is a radio telescope different from both a refracting and a reflecting telescope?

- e. How is a radio telescope similar to both a refracting and a reflecting telescope?

10. Which telescope uses convex lenses? _____

11. The largest visible light telescopes are now all _____.

Observatories (pp. 594–596)

12. A building that contains one or more telescopes is called a(n) _____.

13. Why have astronomers built large optical telescopes on the tops of mountains?

14. Why have astronomers placed telescopes in space?

15. Why can the Hubble Space Telescope make very detailed images in visible light?

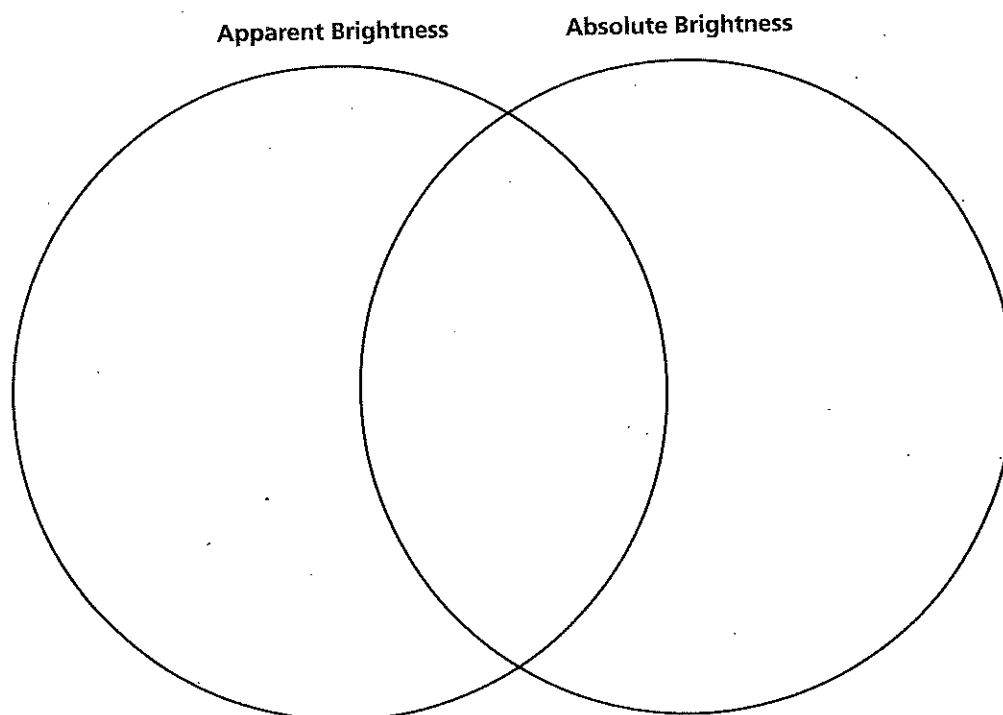
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Characteristics of Stars (pp. 598–605)

This section explains how astronomers measure distances to stars. It also describes how stars are classified.

Use Target Reading Skills

As you read about stars, compare apparent brightness and absolute brightness in the Venn diagram below. Write the similarities in the space where the circles overlap and the differences on the left and right sides.



Introduction (p. 598)

1. Imaginary patterns of stars are called _____.

Classifying Stars (pp. 599–600)

2. What are five characteristics used to classify stars?

a. _____

b. _____

c. _____

d. _____

e. _____

3. What reveals a star's surface temperature?

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4. Circle the letter of what is revealed by the red color of the supergiant star called Betelgeuse.

- a. It is an extremely hot star.
- b. It is in a constellation.
- c. It is far away.
- d. It is a fairly cool star.

5. Stars that are much larger than the sun are called _____.

6. Is the following sentence true or false? Each element has a unique set of lines on a spectrum. _____

7. How can astronomers infer which elements are found in a star?

8. What does a spectrograph do?

9. What is the chemical composition of most stars?

Brightness of Stars (pp. 600–601)

10. The amount of light a star gives off is called its _____.

11. Why does Rigel shine as brightly as Betelgeuse, even though Rigel is much smaller than Betelgeuse?

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Characteristics of Stars *(continued)*

12. What two factors determine how bright a star looks from Earth?

- a. _____
b. _____

13. Complete the table about the measurement of a star's brightness.

Brightness of Stars	
Measurement of Brightness	Definition
Apparent brightness	a.
Absolute brightness	b.

Star X is closer to Earth than Star Y. Star X appears brighter than Star Y.
Use the table to answer the following questions.

c. Compare Star X with Star Y using the term *apparent brightness*.

d. Can you compare the absolute brightness of Star X with Star Y? Why or why not?

14. Is the following sentence true or false? The closer a star is to Earth, the brighter it appears. _____

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15. What two things must an astronomer find out in order to calculate a star's absolute brightness?

a. _____

b. _____

Measuring Distances to Stars (pp. 602–603)

16. Is the following sentence true or false? In space, light travels at a speed of 300,000 kilometers per year. _____

17. What is a light-year?

18. A light-year equals about _____ kilometers.

19. Is the following sentence true or false? The light-year is a unit of time.

20. What is parallax?

21. Astronomers frequently use parallax to measure the distance to which of the following objects?

- a. distant stars
- b. the sun
- c. the planets
- d. nearby stars

22. To measure parallax shift, astronomers look at the same star at two different times of the year, when Earth is on different sides of the

_____.

The Hertzsprung-Russell Diagram (pp. 604–605)

23. The diagram that shows the relationship between the surface temperatures of stars and their absolute brightness is called the

_____.

24. Look at the Hertzsprung-Russell diagram in your textbook. Write what is measured on each of the two axes of the diagram.

a. x-axis (horizontal axis): _____

b. y-axis (vertical axis): _____

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Characteristics of Stars *(continued)*

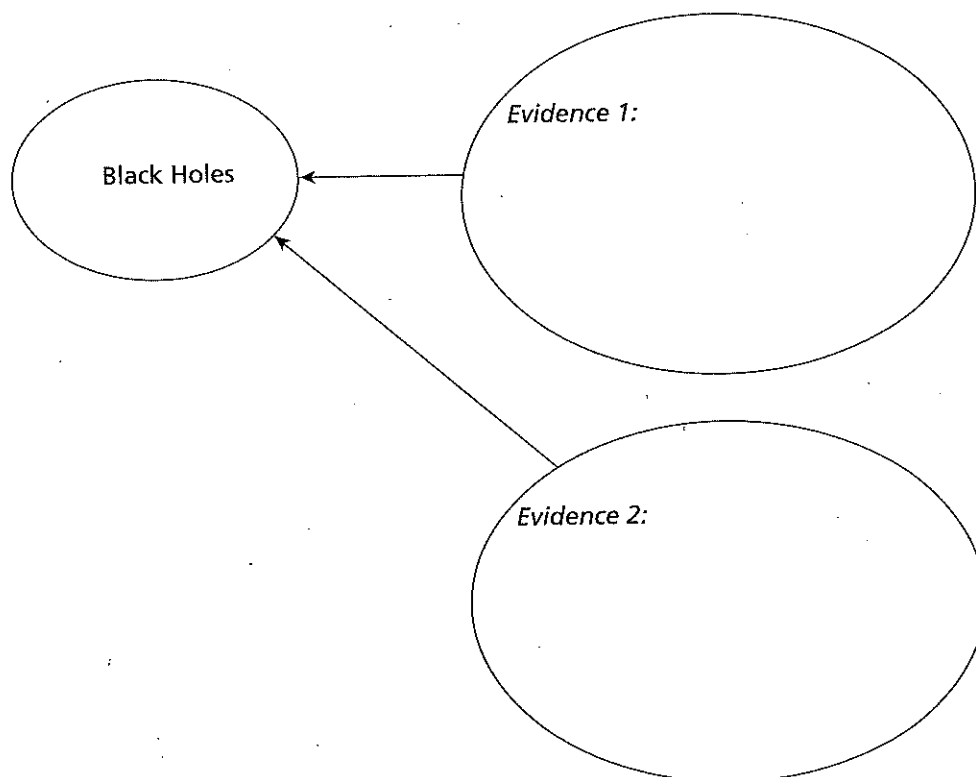
25. An area on the Hertzsprung-Russell diagram that runs from the upper left to the lower right and includes more than 90 percent of all stars is called the _____.
26. Circle the letter of each sentence that is true based on the Hertzsprung-Russell diagram in your textbook.
- a. The sun is a main-sequence star.
 - b. The absolute brightness of white dwarfs is greater than that of supergiants.
 - c. Rigel is hotter than Betelgeuse.
 - d. The absolute brightness of Polaris is greater than that of the sun.

Stars, Galaxies, and the Universe ▪ Reading/Notetaking Guide**Lives of Stars** (pp. 608–613)

This section explains how the life of a star begins. It also explains what determines how long a star lives and what happens when a star runs out of fuel.

Use Target Reading Skills

As you read about black holes, complete the graphic organizer showing supporting evidence for the hypothesis that black holes exist.

**The Lives of Stars** (p. 609)

1. Is the following sentence true or false? All stars begin their lives as parts of nebulas. _____
2. A large amount of gas and dust spread out in an immense volume is called a(n) _____.
3. A contracting cloud of gas and dust with enough mass to form a star is called a(n) _____.
4. Describe how a star is born.

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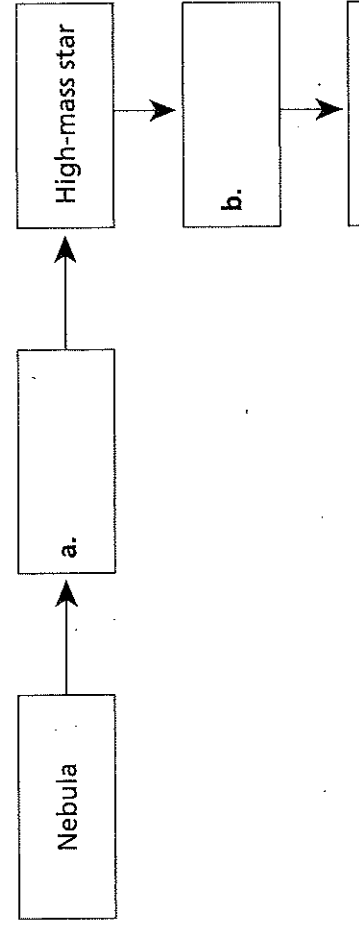
5. Circle the letter of the factor that determines how long a star lives.
- a. its mass
 - b. its brightness
 - c. its volume
 - d. its temperature
6. Is the following sentence true or false? Stars with more mass last longer than stars with less mass. _____

Deaths of Stars (pp. 610–613)

Match each stage of a star with its definition.

Stage of a Star	Definition
7. White dwarf	a. The small, dense remains of a high-mass star that is called a pulsar when it spins
8. Planetary nebula	b. Explosion of a high-mass star
9. Supernova	c. An object whose gravity is so strong nothing can escape
10. Neutron star	d. A glowing cloud of gas formed from the expanding outer layers of a red giant
11. Black hole	e. The cooled core of a star that has run out of fuel

12. Complete the flowchart to show the stages in the life of a high-mass star.



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Lives of Stars *(continued)*

e. What determines which stage occurs after a supernova?

f. How do all stars begin?

g. What is the relationship between mass and the end stages of stars?

13. How do astronomers think the sun may have begun?

14. Since no form of radiation can ever get out of a black hole, how can astronomers detect where black holes are?

Stars, Galaxies, and the Universe ▪ *Reading/Notetaking Guide***Star Systems and Galaxies** (pp. 614–621)

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	

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Star Systems and Clusters (pp. 615–616)

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 (p. 617)

9. What is a galaxy?

10. What is the Local Group?

11. What is a quasar?

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Match the type of galaxy with its shape.

Type of Galaxy	Description of Shape
_____ 12. Spiral galaxy	a. Bulge in middle and arms that spiral outward
_____ 13. Elliptical galaxy	b. Does not have a regular shape
_____ 14. Irregular galaxy	c. Looks like round or flattened ball

15. 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. All galaxies have huge bar-shaped regions of stars that pass through their center.

The Milky Way (p. 619)

16. The galaxy in which our solar system is located is called the _____.

17. What type of galaxy is the Milky Way?

The Scale of the Universe (pp. 620–621)

18. Why do astronomers often use scientific notation?

19. Suppose a star is about 38,000,000,000,000 kilometers away from Earth. How do you write this number in scientific notation?

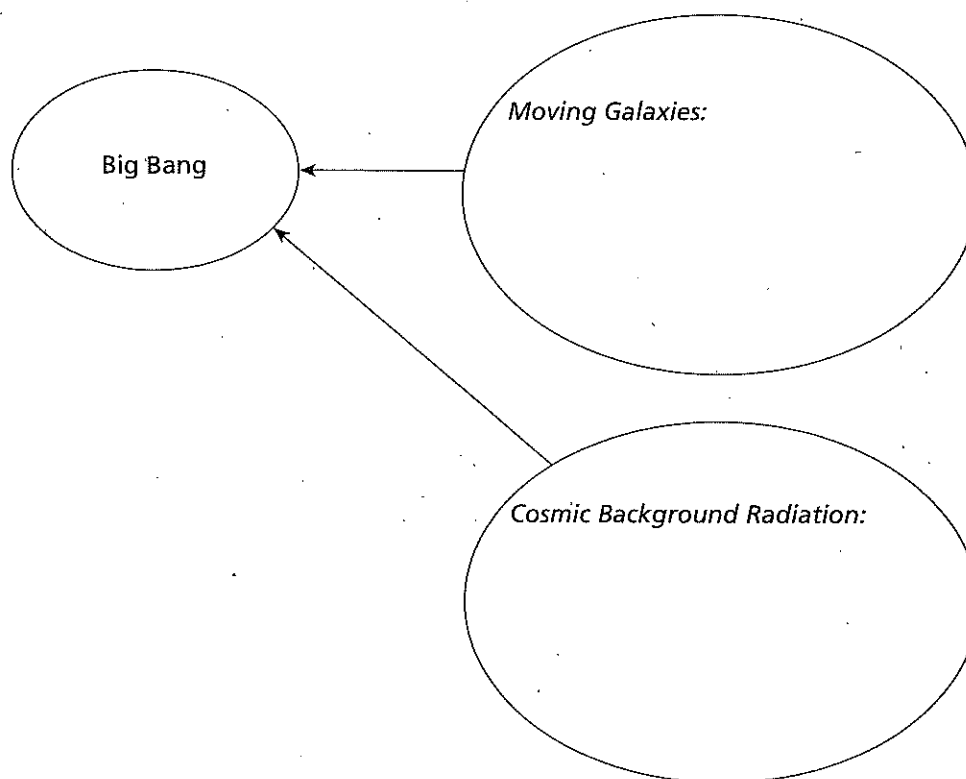
20. How large is the observable universe? _____

Stars, Galaxies, and the Universe ▪ *Reading/Notetaking Guide***The Expanding Universe** (pp. 622–627)

This section explains how astronomers think the universe and the solar system formed.

Use Target Reading Skills

As you read about the evidence that supports the big bang theory, complete the graphic organizer.

**How the Universe Formed** (pp. 622–624)

1. The initial explosion that resulted in the formation and expansion of the universe is called the _____.
2. When did the big bang occur?

3. Is the following sentence true or false? In general, the farther away a galaxy is from us, the faster it is moving away from us. _____
4. How is the universe like rising raisin bread dough?

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5. Radiation left over from the big bang is called _____.
6. How can astronomers infer approximately how long the universe has been expanding?

Formation of the Solar System (p. 625)

7. About how long ago did our solar system form? _____
8. What events led to the birth of the sun?

9. How did planetesimals form planets?

The Future of the Universe (pp. 626–627)

10. Describe two possibilities of what will happen to the universe in the future.

a. _____

b. _____

11. Which possibility in question 10 do astronomers think is more likely? Explain why.
