Target Reading Skill
Identify Supporting Evidence
Create a graphic organizer that shows the evidence supporting the solar nebula theory.

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.

Complete the following sentences so that
your answers clearly explain the key terms.
6. Astronomy was revolutionized by the
   invention of the telescope, which is
   ________.
7. More than 90 percent of stars are found on
   the main sequence, which is
   ________.
8. Stars are formed in nebula, which are
   ________.
9. The Milky Way is an example of a galaxy,
   which is
   ________.
10. Evidence for the big bang includes cosmic
    background radiation, which is
    ________.

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

Video Assessment
Stars, Galaxies, and the Universe
Show the Video Assessment to review chapter content and as a prompt for the writing assignment. Discussion question:
How are a star’s mass and its lifespan related? (More massive stars have shorter lifespans.)
Checking Concepts

11. A light-year is a unit of distance. It measures how far light travels through space 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 $6.04 \times 10^3$ light-years from Earth.

Thinking Critically

19. The moon has no atmosphere that could interfere with the transmission of electromagnetic radiation.
20. Sample answer: High beams on car headlights have a greater absolute brightness 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 use up 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 5,500°C. Aldebaran is a giant with a high absolute brightness and a surface temperature of about 4,000°C. So, Aldebaran is larger and cooler and has a greater absolute brightness than the sun.
Teachers can monitor student progress and supply remediation when necessary.

Standards Practice

Choose the letter of the best answer.

1. You can often see stars at night because
   A. they produce light from nuclear fusion.
   B. they reflect light from the planets.
   C. they reflect light from the sun.
   D. they have exploded as supernovas.  S 8.4.d

2. The most common chemical element in most stars is
   A. oxygen.
   B. hydrogen.
   C. helium.
   D. nitrogen.  S 8.4.b

3. The main factor that affects the evolution of a star is its
   A. color.
   B. apparent brightness.
   C. mass.
   D. parallax.  S 8.4.b

4. An astronomer would likely measure the distance between stars in
   A. light-years.
   B. kilometers.
   C. astronomical units.
   D. millimeters.  S 8.4.c

5. According to the table, the most common type of stars in the Milky Way are
   A. main-sequence stars.
   B. red giants.
   C. supergiants.
   D. white dwarfs.  S 8.4.b

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 Question 5.

<table>
<thead>
<tr>
<th>Type of Star</th>
<th>Percentage of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main sequence</td>
<td>90.75%</td>
</tr>
<tr>
<td>Red Giant</td>
<td>0.50%</td>
</tr>
<tr>
<td>Supergiant</td>
<td>&lt; 0.0001%</td>
</tr>
<tr>
<td>White Dwarf</td>
<td>8.75%</td>
</tr>
</tbody>
</table>

6. The image above shows a galaxy with few or no new stars. It is most likely a(n)
   A. spiral galaxy.
   B. barred spiral galaxy.
   C. irregular galaxy.
   D. elliptical galaxy.  S 8.4.a

7. 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  S 8.4.b

8. What force pulled matter together in the solar nebula to form the solar system?
   A. inertia
   B. nuclear fusion
   C. dark energy
   D. gravity  S 8.2.g

9. 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?  S 8.4.a

Focus on the Big Idea

Sample: 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 within 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. The most recent evidence suggests that the Milky Way is a barred-spiral galaxy, that is, a spiral galaxy with a large bar-shaped region of stars and gas passing through its center.  S 8.4.a

Performance Assessment

Advis 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.

Teaching Resources

Laboratory Manual TE

Standards Investigation Scoring Rubric

The Standards Investigation scoring rubric will help you evaluate students’ work. If you shared the rubric in advance, students will know what is expected of them.