

CHAPTER

STUDY GUIDE

GALAXIES AND THE UNIVERSE**SECTION 30.1 The Milky Way Galaxy**

In your textbook, read about discovering the Milky Way.

For each item in Column A, write the letter of the matching item in Column B.

Column A

- _____ 1. Stars in the giant branch of the H-R diagram that pulsate in brightness because of the expansion and contraction of their layers
- _____ 2. Stars that have periods of pulsations between 1.5 hours and 1.2 days, and on average, have the same luminosity
- _____ 3. Stars with pulsation periods between 1 day and more than 100 days
- _____ 4. By measuring a star's period of pulsation, astronomers can determine this
- _____ 5. Direction of the center of the Milky Way is toward this constellation

Column B

- a. Cepheid variables
- b. luminosity
- c. RR Lyrae variables
- d. Sagittarius
- e. variable stars

In your textbook, read about the shape of the Milky Way.

For each statement below, write true or false.

- _____ 6. Radio waves are used to map the Milky Way because they can penetrate the interstellar gas and dust without being scattered or absorbed.
- _____ 7. The Milky Way's galactic nucleus is surrounded by a nuclear bulge that sticks out of the galactic disk.
- _____ 8. Measurements of star luminosity at different distances provide a hint of the Milky Way's spiral arms.
- _____ 9. Around the Milky Way's nuclear bulge and disk is the halo, where the globular clusters are located.
- _____ 10. Astronomers mapped the emission wavelength of nitrogen gas in space to conclusively determine the existence of spiral arms in the Milky Way.
- _____ 11. Five major spiral arms and a few minor arms were identified in the Milky Way.
- _____ 12. The Sun is located in the Milky Way's minor arm Orion at a distance of 26,000 ly from the galactic center.
- _____ 13. In its 5-billion-year life, the Sun has orbited the galaxy approximately 100 times.

SECTION 30.1 The Milky Way Galaxy, continued

In your textbook, read about the mass of the Milky Way.

Use each of the terms below just once to complete the passage.

2.6 million	100 billion	dark matter	galaxy
stellar remnants	halo	supermassive black hole	

The mass located within the circle of the Sun's orbit through the galaxy is about
(14) _____ times the mass of the Sun. Because the Sun is of average mass,
 astronomers have concluded there are about 100 billion stars within the disk of the
(15) _____.

Astronomers have found evidence that much more mass exists in the outer galaxy.
 Evidence indicates that as much as 90 percent of the galaxy's mass is contained in the
(16) _____. This mass is not observed in the form of normal stars,
 and astronomers hypothesize that some of this unseen matter is in the form of dim
(17) _____, such as white dwarfs, neutron stars, and black holes.
 The remainder of this mass, usually called **(18)** _____, is a mystery.

Studies of the motion of stars that orbit close to Sagittarius A indicate that this area has
 about **(19)** _____ times the mass of the Sun, but is smaller than our solar
 system. Astronomers believe that Sagittarius A is a **(20)** _____ that glows
 brightly because of the hot gas surrounding it and spiraling into it.

SECTION 30.2 Other Galaxies in the Universe

In your textbook, read about discovering other galaxies.

Circle the letter of the choice that best completes the statement or answers the question.

- The question about other objects existing in the sky was answered by Edwin Hubble in 1924. What did he discover in the Great Nebula in the Andromeda constellation?
 - Cepheid variable stars
 - a supernova
 - RR Lyrae variables
 - a black hole
- Disklike galaxies with spiral arms are divided into which of the following two subclasses?
 - normal spirals and flat spirals
 - normal spirals and barred spirals
 - flat spirals and barred spirals
 - loose spirals and flat spirals
- Galaxies that are not flattened into disks and do not have spiral arms are called
 - dwarf galaxies.
 - barred elliptical galaxies.
 - elliptical galaxies.
 - nebular galaxies.
- Galaxies that do not fit into the spiral or elliptical classifications are called
 - dwarf galaxies.
 - Hubble galaxies.
 - barred galaxies.
 - irregular galaxies.

In your textbook, read about groups and clusters of galaxies.

For each statement, write true or false.

- _____ 5. Most galaxies are spread evenly throughout the universe.
- _____ 6. The Milky Way belongs to a small cluster of galaxies called the Local Group.
- _____ 7. The Milky Way and the Andromeda Galaxy are two of the smallest members of the Local Group.
- _____ 8. When galaxies move away from each other, they form strangely shaped galaxies or galaxies with more than one nucleus.
- _____ 9. Studies of clusters of galaxies provide astronomers with the strongest evidence that most of the matter in the universe is visible and accounted for.

In your textbook, read about the expanding universe, active galaxies, and quasars.

For each item in Column A, write the letter of the matching item in Column B.

- | Column A | Column B |
|--|---------------------------|
| _____ 10. Feature in the spectra of galaxies that indicates that they are moving away from Earth | a. active galactic nuclei |
| _____ 11. About 70 km per second per megaparsec | b. Hubble constant |
| _____ 12. Extremely bright galaxies that are often giant elliptical galaxies emitting as much or more energy in radio wavelengths than in wavelengths of visible light | c. quasars |
| _____ 13. Starlike objects with emission lines in their spectra | d. radio galaxies |
| _____ 14. Provide important clues for astronomers to study the origin and evolution of the universe | e. redshift |

SECTION 30.3 Cosmology

In your textbook, read about models of the universe.

Use each of the terms below just once to complete the passage.

2.725 K	background noise	Big Bang	Wilkinson Microwave Anisotropy Probe
compressed	radiation	lower	cosmic background radiation
cosmology	density	expanding	open closed

The study of the universe, including its current nature, its origin, and its evolution is called (1) _____. The fact that the universe is (2) _____ implies that it had a beginning. The theory that the universe began as a point and has been expanding ever since is called the (3) _____ theory. The (4) _____ of the universe determines the outcome of the Big Bang. In a(n) (5) _____ universe the expansion will never stop. In a(n) (6) _____ universe the expansion stops and becomes a contraction.

According to the more accepted theory, the Big Bang Theory, if the universe began in a highly (7) _____ state, it would have been very hot, and the high temperatures would have filled it with (8) _____. As the universe expanded and cooled, the radiation would have been shifted to (9) _____ energies and longer wavelengths. In 1965, scientists discovered a persistent (10) _____ in their radio antenna. The noise was caused by weak radiation called the (11) _____. It appeared to come from all directions in space and corresponded to an emitting object having a temperature of about (12) _____, which is close to the temperature predicted by the Big Bang theory. An orbiting observatory called the (13) _____, launched in 2001, mapped the radiation in detail.

SECTION 30.3 Cosmology, continued

In your textbook, read about the Big Bang model.

Circle the letter of the choice that best completes the statement or answers the question.

14. What are the three possible outcomes for the universe?
- open universe, closed universe, and flat universe
 - expanding universe, closed universe, and flat universe
 - open universe, closed universe, and static universe
 - open universe, barred universe, and flat universe
15. All three possible outcomes for the universe are based on the premise that the rate of expansion has
- remained the same since the beginning of the universe.
 - slowed down since the beginning of the universe.
 - increased since the beginning of the universe.
 - doubled since the beginning of the universe.
16. The total amount of matter in the universe is expressed in terms of the
- critical density of matter.
 - average critical density of matter.
 - average density of matter.
 - absolute density of matter.
17. Observations of visible galaxies reveal a(n)
- average density equal to critical density.
 - average density much less than critical density.
 - absolute density greater than average critical density.
 - critical density much less than average density.
18. Evidence suggests that the universe contains a great amount of
- visible matter.
 - invisible matter.
 - mystery matter.
 - dark matter.
19. The universe began as a point and has been expanding ever since is called the
- Big Bang theory.
 - flat universe model.
 - critical density theory.
 - Hubble constant model.
20. When the rate of expansion of the universe is known, it is possible to calculate the
- date the universe will end.
 - date the universe began.
 - distance to each galaxy.
 - age of the universe.
21. Based on the best value for H that has been calculated, the age of the universe is hypothesized to be about
- 1.3 billion years.
 - 13.7 million years.
 - 13.7 billion years.
 - 13 trillion years.