

## Universe and Galaxy Short Study Guide

### Multiple Choice

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

- \_\_\_\_\_ 1. Other galaxies were first believed to be \_\_\_\_\_.  
a. nebulae or star clusters within the Milky Way  
b. quasars outside the Milky Way  
c. constellations within the Milky Way  
d. the Andromeda galaxy
- \_\_\_\_\_ 2. Elliptical galaxies are divided into subclasses based on \_\_\_\_\_.  
a. their elongated shapes  
b. the length of their diameters  
c. the ratio of their major and minor axes  
d. the length of their spiral arms
- \_\_\_\_\_ 3. Cosmic background radiation has a wavelength of approximately 1 mm, which makes it \_\_\_\_\_.  
a. gamma ray radiation  
b. microwave radiation  
c. X-ray radiation  
d. infrared radiation
- \_\_\_\_\_ 4. If the average density is higher than the critical density, the universe is \_\_\_\_\_.  
a. closed  
b. open  
c. flat  
d. round
- \_\_\_\_\_ 5. Recent observations show that the rate of expansion of the universe is \_\_\_\_\_.  
a. slowing down  
b. stabilizing  
c. constantly changing  
d. speeding up
- \_\_\_\_\_ 6. A flat universe was first predicted in the 1980's by the \_\_\_\_\_.  
a. Big Bang theory  
b. steady-state theory  
c. inflationary universe model  
d. flat universe model

### Matching

Match each item with the correct statement below.

- |                                |                            |
|--------------------------------|----------------------------|
| a. inflationary universe       | e. steady-state theory     |
| b. cosmology                   | f. Hubble constant         |
| c. Big Bang theory             | g. active galactic nucleus |
| d. cosmic background radiation | h. superclusters           |
- \_\_\_\_\_ 7. Core of a galaxy in which highly energetic objects or activities are located
- \_\_\_\_\_ 8. Gigantic formation of clusters of galaxies hundreds of millions of light-years in size
- \_\_\_\_\_ 9. A value of approximately 70 kilometers per second per megaparsec
- \_\_\_\_\_ 10. States that the universe began as a point and has been expanding ever since
- \_\_\_\_\_ 11. Persistent noise discovered in 1965 that is caused by weak radiation from all directions in space
- \_\_\_\_\_ 12. Model that says the universe began as a fluctuation in a vacuum and expanded very rapidly for a fraction of a second before settling into a more orderly expansion

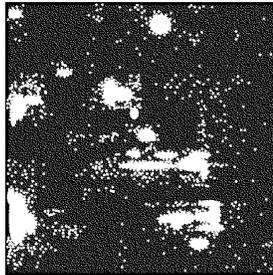
Match each letter notation with its corresponding galaxy shape below.

- |               |              |
|---------------|--------------|
| a. <i>E7</i>  | e. <i>SO</i> |
| b. <i>Irr</i> | f. <i>EO</i> |
| c. <i>a</i>   | g. <i>S</i>  |
| d. <i>c</i>   | h. <i>SB</i> |

- \_\_\_\_\_ 13. Barred spiral
- \_\_\_\_\_ 14. Loosely wound arms and a small, dim nucleus
- \_\_\_\_\_ 15. Flat disks that do not have spiral arms
- \_\_\_\_\_ 16. Round elliptical

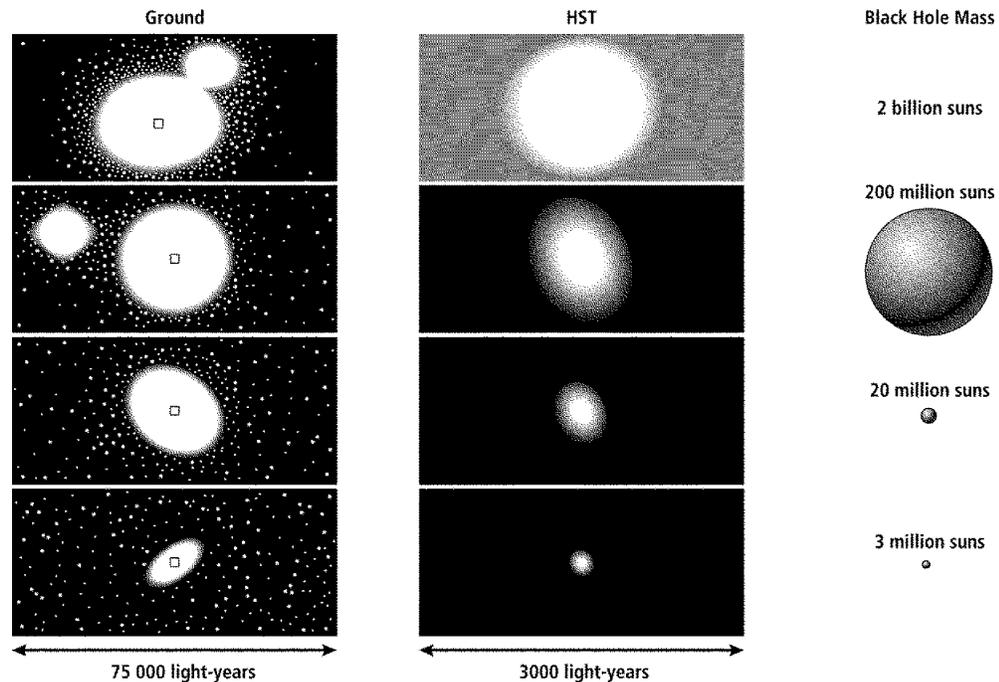
**Short Answer**

- 17. Briefly explain the theory of the universe which is supported by the most evidence.
- 18. Identify the type of galaxy, write a brief description and give an example of the galaxy type.



- 19. What elements make up the stars in globular clusters?
- 20. How do astronomers explain the formation of the Milky Way galaxy?

## Black Holes: One Size Does Not Fit All



Astronomers are concluding that monstrous black holes were not born that big, as once believed, but instead grew on a diet of gas and stars controlled by their host galaxies in the beginning years of the universe. An initial look at 30 galaxies indicates that black holes do not precede a galaxy's birth, but instead evolve with the galaxy by trapping an amazingly exact percentage (0.2) of the mass of the stars and gas in a galaxy.

Black holes in the centers of giant galaxies—some more than one billion solar masses—had enough infalling gas to once blaze as quasars. The final mass of a black hole is not primordial, but instead is determined during the galaxy formation process. This shows that there is a close relationship between the black hole mass and the stars that comprise an elliptical galaxy or central bulge stars of a spiral galaxy. In most cases, the black holes not only bulked up through the accretion of gas, but also through mergers of galaxies in which pairs of black holes combined.

The Hubble Space Telescope precisely measures the speed of gas and stars around a black hole. This measurement provides clues for the existence of a black hole. Astronomers determine the mass of each black hole by measuring the motion of stars swirling around it. The closer a star is to the black hole, the faster is its velocity.

21. In the chart above, what unit of measurement is used to show black hole mass?

## Universe and Galaxy Short Study Guide Answer Section

### MULTIPLE CHOICE

1. A
2. C
3. B
4. A
5. D
6. C

### MATCHING

7. G
8. H
9. F
10. C
11. D
12. A
  
13. H
14. D
15. E
16. F

### SHORT ANSWER

17. The Big Bang theory states that the universe began as a point and has been expanding ever since. The theory does not suggest an explosion into space, but instead that there is an expansion of space with matter going along for the ride.
18. galaxy clusters. These groups of galaxies may have from a few to hundreds of member galaxies and may range in sizes up to 30 million ly. In a cluster, most of the inner region galaxies are ellipticals. Galaxies in the outer portions are a mix of ellipticals and spirals. The galaxies often merge to form strangely shaped galaxies or galaxies with more than one nucleus. Possible example: Local Group.
19. The stars in globular clusters have a proportion of hydrogen and helium as high as 99.9 percent, with the rest of the elements being mere traces of heavy elements.
20. Since old stars are found in the halo and bulge, astronomers believe that these parts formed first and that the galaxy began as a round cloud. This explains why the halo, which contains the oldest stars, is spherical. The central bulge represents the inner portion of the original cloud. The cloud eventually collapsed under the force of its own gravity, and rotation forced it into a disklike shape. Stars that formed after this time orbit in the plane of the disk.
21. suns