

LESSON E&S 5.3 – THE UNIVERSE

EVIDENCE NOTEBOOK

KEY IDEAS

1. What trend do you notice between the shape of very large asteroids (300+ km diameter) and the smaller ones?
2. Complete the table and include the unit of measurement:

Object	Diameter
Asteroid 2008 TC3	
Asteroid 433 Eros	
Ceres	
The Moon	
Mercury	
Venus	
Earth	
Mars	
Jupiter	
Saturn	
Uranus	
Neptune	
The Sun	

3. How many Suns could you fit between Earth and The Sun?
4. How many kilometers are in an astronomical unit?

5. Complete the table and include the unit of measurement:

Object	Distance from The Sun
Mercury	
Venus	
Earth	
Mars	
The Asteroid Belt	
Jupiter	
Saturn	
Uranus	
Neptune	
Kuiper Belt	
Proxima Centauri	
Rosette Nebula	

6. What is the speed of light in meters per second?

7. In one year, light will travel:

a. how many kilometers?

b. how many AU?

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8. Complete the table and include the unit of measurement:

Object	Distance
Diameter of the Rosette Nebula	
Diameter of the Milky Way	
Thickness of the Milky Way	
Distance to Messier 59	
Distance to NGC 1427A	
Diameter of The Local Group	
Diameter of the Virgo Supercluster	
Distance to the GN-z11 Galaxy	
The radius of the Observable Universe	

9. Illustrate the following galaxy shapes and give an example of each:

a. Spiral

b. Elliptical

c. Irregular

10. The Local Group

- a. What is The Local Group?

- b. Name the two largest galaxies in The Local Group

11. Superclusters

- a. What are superclusters?

- b. What supercluster do we belong to?

12. Explain why the farther away an object is the older the image is.

13. Explain how we can see objects further away than the age of the universe.

CHECKPOINTS

14. The sun's diameter is approximately 1.4×10^6 km, and the Earth's is just under 1.3×10^4 km. The Milky Way is about 9.5×10^{17} km across. Which statement is true?

- a. The sun is 2 times wider than Earth; the Milky Way is 11 times wider than the sun.
- b. The sun is 100 orders of magnitude wider than Earth; the Milky Way is 100 billion orders of magnitude wider than the sun.
- c. The sun is 2 AU wider than Earth; the Milky Way is 11 light-years wider than the sun.
- d. The sun is 2 orders of magnitude wider than Earth; the Milky Way is 12 orders of magnitude wider than the sun.

15. What is the correct order of the following objects and measurements, from smallest to largest?

(Hint: Look carefully at the units.)

Hydrogen atom	2.4×10^{-15} m
Distance to the nearest white dwarf star	8.58 ly
Diameter of the nearest white dwarf star	2 million km
Distance to Orion nebula	1,344 ly
Diameter of Earth	13,000 km
Distance to Alpha Centauri	4.4 ly

16. Which of the following accurately describe the reason for or result of patterns of motion in our universe? *Choose all correct answers.*

- a. Reason: Gravitational attraction caused materials to accrete in a central mass; motion typically began around a central axis.
- b. Result: Supernovas occur due to the immense centrifugal force generated by the spinning of a star.
- c. Result: Planets spin, rings move around planets, planets journey around the sun, stars spin, galaxies spin.
- d. Reason: Motion observed is residual motion resulting from the physical forces of the big bang.

17. Look at the image below.

- a. What type of galaxy is this?
- b. Based on your observations, do you think the galaxy is rotating in a clockwise or counterclockwise direction? *Explain your reasoning.*



18. Match each distance to the unit that is best used to describe it.

- | | |
|---|---|
| a. Distance from Ramstein, Germany to Madrid, Spain | 1. Light-year |
| b. Distance to the edge of the universe | 2. Gigalight-year (one billion light years) |
| c. Distance to Andromeda galaxy | 3. Astronomical unit |
| d. Distance to Pluto | 4. Kilometer |

19. Which of these celestial bodies is not considered to be a major planet by scientists?
- a. Pluto
 - b. Saturn
 - c. Mercury
 - d. Neptune
20. Which of these is a region of the solar system that starts just beyond Neptune's orbit and that contains dwarf planets and other small bodies made mostly of ice?
- a. the TNO
 - b. the Kuiper Belt
 - c. the asteroid belt
 - d. the outer atmosphere
21. Which of these are objects that circle stars other than Earth's sun?
- a. Moons
 - b. Nebulas
 - c. Exoplanets
 - d. Planetesimals
22. What type of galaxy is the Milky Way?
- a. Spiral
 - b. Elliptical
 - c. Irregular
 - d. Spherical
23. What is an irregular galaxy?
- a. a galaxy with no particular shape
 - b. a galaxy that has vast areas without stars
 - c. a galaxy shaped like a stretched-out football
 - d. a galaxy that has high mass and is rich in dust and gas
24. Which of these lists objects from closest to farthest from Earth?
- a. Jupiter, Kuiper Belt, sun
 - b. Jupiter, sun, Kuiper Belt
 - c. sun, Kuiper Belt, Jupiter
 - d. sun, Jupiter, Kuiper Belt

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25. Which description would most likely apply to an older star?
- a. is composed mostly of lithium and is located in a galactic cluster
 - b. is composed mostly of helium and is located in a galactic cluster
 - c. is composed mostly of carbon and is located in a globular cluster
 - d. is composed mostly of hydrogen and is located in a globular cluster