

Chapter 1: Thinking Like an Astronomer

LEARNING OBJECTIVES

1.1 Earth Occupies a Small Place in the Universe

Define the bold-faced vocabulary terms within the chapter.
Multiple Choice: 1, 9, 14, 21, 29, 31, 36, 37, 40, 42, 43, 44
Short Answer: 11, 17, 18

List our cosmic address.
Multiple Choice: 22
Short Answer: 5

Differentiate the various components of our cosmic address.
Multiple Choice: 2, 6, 23
Short Answer: 1, 3

Relate the different sizes of, or the different distances between, the components of our cosmic address.
Multiple Choice: 10, 11, 15, 24, 25
Short Answer: 16

Relate astronomical distances with light-travel time.
Multiple Choice: 4, 7, 16, 17, 18, 19, 20, 26, 27, 28
Short Answer: 2, 4, 6, 10

Illustrate the size or history of the universe with scaled models.
Multiple Choice: 3, 5, 8, 12, 13
Short Answer: 7, 8, 9

1.2 Science Is a Way of Viewing the Universe

Compare the everyday and scientific meanings of *theory*.
Multiple Choice: 33, 35, 39
Short Answer: 23

Compare an *idea* with a *hypothesis*.
Multiple Choice: 32, 34
Short Answer: 12

Describe the steps of the scientific method.
Multiple Choice: 38, 41
Short Answer: 14, 20

Assess whether a given idea or explanation is scientific.
Multiple Choice: 45, 46
Short Answer: 13

Establish why all scientific knowledge is provisional.
Multiple Choice: 30
Short Answer: 15, 19, 21, 22

1.3 Astronomers Use Mathematics to Find Patterns

Identify patterns in nature.
Multiple Choice: 47, 48, 51
Short Answer: 24, 25, 26

Summarize the evidence for the statement “We are actually made of recycled stardust.”
Multiple Choice: 50, 52, 54
Short Answer: 27, 29, 30

Identify fields of science that relate to the study of origins.
Multiple Choice: 53
Short Answer: 28

Working It Out 1.1

Write numbers in both scientific and standard notation.
Multiple Choice: 49, 55, 57, 58, 68

Describe characteristics of real-world objects in terms of ratios.
Multiple Choice: 56, 59, 60

Determine the mathematical behavior of proportional systems.
Multiple Choice: 61, 62, 63, 64

Working It Out 1.2

Identify the x and y axes on a graph.
Define *slope* on a graph.
Read data from linear and logarithmic graphs.
Multiple Choice: 65, 66, 69, 70

Distinguish between linear and exponential curves on a graph.
Multiple Choice: 67

MULTIPLE CHOICE

1. The word *astronomy* means
- “patterns among the stars.”
 - “to study the stars.”
 - “discovering the universe.”
 - “the movement of the stars.”
 - “personality traits set by the stars.”

ANS: A DIF: Easy REF: Section 1.1

MSC: Remembering

OBJ: Define the bold-faced vocabulary terms within the chapter.

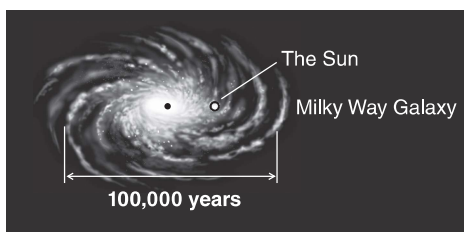
2. The number of planets in our Solar System is
- six.
 - eight.
 - nine.
 - twelve.

ANS: B DIF: Easy REF: Section 1.1

MSC: Remembering

OBJ: Differentiate the various components of our cosmic address.

3. According to the figure below, Earth is located approximately



- at the center of the Milky Way.
- near the center of the Milky Way.
- about halfway out from the center of the Milky Way.
- at the farthest outskirts of the Milky Way.
- outside the Milky Way, which is why we can see it as a band across the night sky.

ANS: C DIF: Easy REF: Section 1.1

MSC: Understanding

OBJ: Illustrate the size or history of the universe with scaled models.

4. The average distance between Earth and the Sun is 1.5×10^{11} m, and light from the Sun takes approximately _____ to reach Earth.

- 8 seconds
- 8 minutes
- 8 hours
- 8 days
- 8 years

ANS: B DIF: Easy REF: Section 1.1

MSC: Applying

OBJ: Relate astronomical distances with light-travel time.

5. Our universe is approximately 13.7 _____ years old.

- thousand
- million
- billion
- trillion

ANS: C DIF: Easy REF: Section 1.1

MSC: Remembering

OBJ: Illustrate the size or history of the universe with scaled models.

6. Milky Way is the name of
- our solar system.
 - the galaxy in which we live.
 - the local group of galaxies we are in.
 - the supercluster of galaxies we are in.

ANS: B DIF: Easy REF: Section 1.1

MSC: Understanding

OBJ: Differentiate the various components of our cosmic address.

7. One of the nearest stars is Alpha Centauri, whose distance is 4.4 light-years. The time it takes light to travel from Alpha Centauri to us is

- 1.25 seconds.
- 8.3 minutes.
- 4.4 years.
- 600 years.

ANS: C DIF: Easy REF: Section 1.1

MSC: Applying

OBJ: Relate astronomical distances with light-travel time.

8. The time it takes light to cross Neptune's orbit is closest to which of the following?
- a second
 - a quick meal
 - a night's sleep
 - the time between presidential elections

ANS: C DIF: Easy REF: Section 1.1
MSC: Remembering
OBJ: Illustrate the size or history of the universe with scaled models.

9. A light-hour is a measure of
- time.
 - distance.
 - speed.
 - acceleration.

ANS: B DIF: Easy REF: Section 1.1
MSC: Remembering
OBJ: Define the bold-faced vocabulary terms within the chapter.

10. If one thinks about the distance between Earth and the Moon, 384,400 km, approximately how much of that distance would Saturn and its rings take up?
- much more than this distance
 - less than half this distance
 - more than half this distance
 - exactly equal to this distance

ANS: B DIF: Medium REF: Section 1.1
MSC: Remembering
OBJ: Relate the different sizes of, or the different distances between, the components of our cosmic address.

11. The diameter of the Moon is
- larger than the distance across the continental United States.
 - roughly equal to the longest distance across Texas.
 - more than half the distance across the continental United States.
 - less than half the distance across the continental United States.

ANS: C DIF: Medium REF: Section 1.1
MSC: Remembering
OBJ: Relate the different sizes of, or the different distances between, the components of our cosmic address.

12. The early universe was composed mainly of which two elements?
- hydrogen and helium
 - carbon and oxygen
 - hydrogen and oxygen
 - carbon and iron
 - nitrogen and oxygen

ANS: A DIF: Easy REF: Section 1.1
MSC: Remembering
OBJ: Illustrate the size or history of the universe with scaled models.

13. What is the approximate number of stars in the Milky Way?
- 10 million
 - 300 million
 - 10 billion
 - 300 billion
 - 1 trillion

ANS: D DIF: Medium REF: Section 1.1
MSC: Remembering
OBJ: Illustrate the size or history of the universe with scaled models.

14. The Local Group is the environment around
- the Earth-Moon system.
 - the Sun that contains about a dozen stars.
 - the Sun that contains over a million stars.
 - the Milky Way that contains a few dozen galaxies.
 - the Milky Way that contains a few thousand galaxies.

ANS: D DIF: Medium REF: Section 1.1
MSC: Remembering
OBJ: Define the bold-faced vocabulary terms within the chapter.

15. The majority of the mass in our universe is made up of
- planets.
 - stars.
 - galaxies.
 - dust.
 - dark matter.

ANS: E DIF: Medium REF: Section 1.1
MSC: Remembering
OBJ: Relate the different sizes of, or the different distances between, the components of our cosmic address.

16. The speed of light is approximately
- 3,000 km/s.
 - 30,000 km/s.
 - 300,000 km/s.
 - 3 million km/s.
 - 3 billion km/s.

ANS: C DIF: Easy REF: Section 1.1

MSC: Remembering

OBJ: Relate astronomical distances with light-travel time.

17. If an event were to take place on the Sun, how long would it take for the light it generates to reach us?
- 8 minutes
 - 11 hours
 - 1 second
 - 1 day
 - It would reach us instantaneously.

ANS: A DIF: Easy REF: Section 1.1

MSC: Applying

OBJ: Relate astronomical distances with light-travel time.

18. One of the nearest stars is Alpha Centauri, whose distance is 4.2×10^{16} m. How long does it take light to travel from Alpha Centauri to us?
- 1.25 seconds
 - 8.3 minutes
 - 4.4 years
 - 560 years
 - 6,200 years

ANS: C DIF: Medium REF: Section 1.1

MSC: Applying

OBJ: Relate astronomical distances with light-travel time.

19. The distance to the nearest large spiral galaxy, the Andromeda Galaxy, is 2.4×10^{22} m. How long does it take light to travel from Andromeda to us?
- 4.4 years
 - 360 years
 - 1.2 thousand years
 - 2.5 million years
 - 4.5 billion years

ANS: D DIF: Medium REF: Section 1.1

MSC: Applying

OBJ: Relate astronomical distances with light-travel time.

20. The distance to the center of the Laniakea cluster of galaxies is 5×10^{23} m. How long does it take light to travel from these galaxies to us?

- 7,000 years
- 54,000 years
- 120,000 years
- 12 million years
- 54 million years

ANS: E DIF: Medium REF: Section 1.1

MSC: Applying

OBJ: Relate astronomical distances with light-travel time.

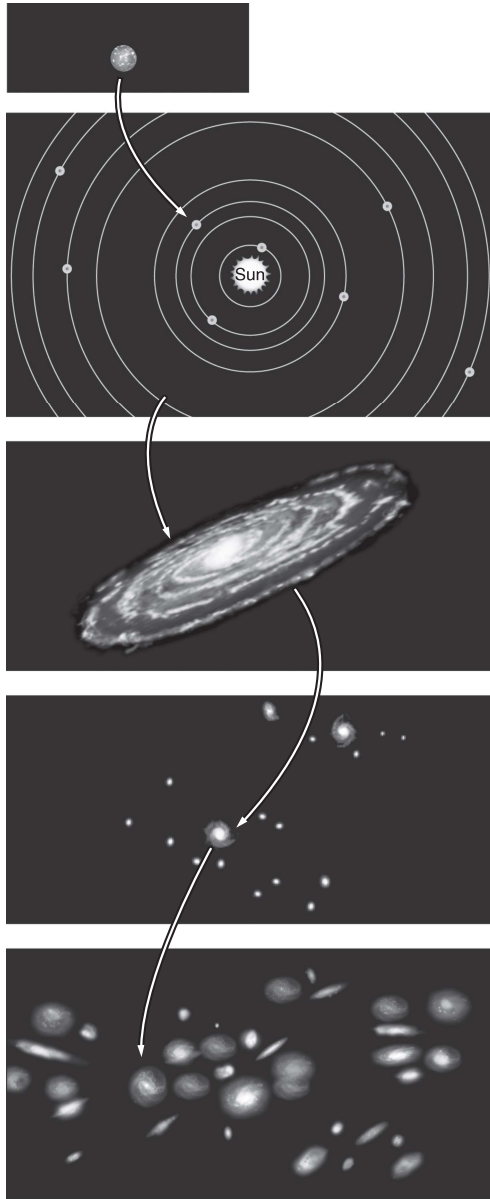
21. A light-year is a unit commonly used in astronomy as a measure of
- time.
 - speed.
 - mass.
 - distance.
 - acceleration.

ANS: D DIF: Medium REF: Section 1.1

MSC: Remembering

OBJ: Define the bold-faced vocabulary terms within the chapter.

22. According to the figure below, if you were to specify your address in the universe, listing your membership from the smallest to largest physical structures, it would be



- Earth, Local Group, Solar System, Andromeda, the universe.
- Earth, Solar System, Local Group, Milky Way, the universe.
- Earth, Solar System, Milky Way, Local Group, Laniakea Supercluster, the universe.
- Earth, Solar System, Milky Way, Laniakea Supercluster, the universe.
- Earth, Laniakea Supercluster, Milky Way, Solar System, the universe.

ANS: C DIF: Difficult REF: Section 1.1
 MSC: Understanding
 OBJ: List our cosmic address.

23. Which of the following is *false*?
- The Local Group is a member of the Laniakea Supercluster, which contains thousands of galaxies.
 - The Local Group contains two large spiral galaxies and a few dozen dwarf galaxies.
 - Our Solar System has eight classical planets.
 - The Milky Way Galaxy contains approximately 100 million stars.
 - The Laniakea Supercluster is one of many superclusters in the universe.

ANS: D DIF: Difficult REF: Section 1.1
 MSC: Understanding
 OBJ: Differentiate the various components of our cosmic address.

24. If the diameter of the Milky Way is approximately 100,000 light-years, then our galaxy is _____ times larger than our Solar System. For reference, Pluto's orbit has an approximate diameter of 80 astronomical units (AU).
- 100
 - 1,000
 - 10,000
 - 10^6
 - 10^8

ANS: E DIF: Difficult REF: Section 1.1
 MSC: Applying
 OBJ: Relate the different sizes of, or the different distances between, the components of our cosmic address.

25. The majority of the energy in our universe is
- radiated by stars from the nuclear fusion going on in their cores.
 - the kinetic energy found in the collisions of galaxies.
 - the gravitational potential energy of superclusters.
 - emitted in radioactive decays of unstable elements.
 - made up of dark energy that permeates space.

ANS: E DIF: Difficult REF: Section 1.1
 MSC: Remembering
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