

*Indicate whether the statement is true or false.*

1. Of all the planets in the solar system, Earth is the only planet to currently have large quantities of liquid water on its surface.
  - a. True
  - b. False
  
2. The ocean holds more than 97 percent of Earth's water.
  - a. True
  - b. False
  
3. Gravity was important in the formation of our planet because it pulled dense metals such as iron and nickel inward, forming Earth's core.
  - a. True
  - b. False
  
4. Deep-sea fossils suggest that life evolved within the last million years.
  - a. True
  - b. False
  
5. There is convincing evidence that water once flowed on the surface of Mars.
  - a. True
  - b. False
  
6. The universe began to form around 13 billion years ago.
  - a. True
  - b. False
  
7. Marine science draws on information from disciplines of geology, biology, chemistry, physics, and engineering.
  - a. True
  - b. False
  
8. Scientific hypotheses are never revised or updated.
  - a. True
  - b. False
  
9. Saturn's moon, Titan, is known to possess liquid hydrocarbons on its surface.
  - a. True
  - b. False
  
10. The average land elevation on Earth is greater than the average depth of the ocean.
  - a. True
  - b. False

*Indicate the answer choice that best completes the statement or answers the question.*

11. The temperature of the ocean about four billion years ago was \_\_\_\_.
- about the same as today's ocean
  - much colder than that of today's ocean
  - extremely hot compared with today's ocean
  - only slightly warmer than today's ocean
12. Planets other than Earth with liquid on or near the surface are \_\_\_\_.
- nonexistent
  - less rare than we thought
  - extremely common but only in the form of water
  - extremely common but only in the form of ice
13. About \_\_\_\_ percent of Earth's water is found in the ocean.
- 97
  - 71
  - 67
  - 30
14. Evidence suggests the universe began about 13.7 billion years ago in a \_\_\_\_.
- slow accretion of atoms
  - very large galaxy
  - cataclysmic expansion of energy and matter
  - protostar
15. What theory best explains how the universe was formed?
- condensation theory
  - scientific method
  - outgassing theory
  - big bang theory
16. Which phrase best describes biosynthesis?
- The discovery of organic molecules in space
  - The evolution of living organisms from simple organic building blocks
  - The evolution of inorganic molecules in seawater
  - Experiments that show that early organisms lived in an oxygen-free environment
17. To recreate an environment for biosynthesis, scientists included which element in their experiments?
- extremely cold temperatures
  - oxygen
  - ocean water
  - mixtures of dissolved compounds and gases thought to be similar to Earth's early atmosphere
18. On a planetary scale, the ocean comprises about \_\_\_\_ of Earth's mass.
- 8%
  - 71%
  - 20%
  - 0.02%

19. Scientists predict that our planet in its current form will exist for about another \_\_\_\_.
- 5 billion years
  - 1 million years
  - 500 million years
  - 13 billion years
20. Oxygen first began to accumulate in Earth's atmosphere as a result of \_\_\_\_.
- biosynthesis
  - cellular respiration
  - methane synthesis
  - photosynthesis
21. Which statement is most consistent with the scientific method?
- Hypotheses cannot be revised after they are proposed.
  - Hypotheses are tested through observation and controlled experiments.
  - Scientific laws always arise fully formed and in correlating groups.
  - Theories cannot be modified after they are tested.
22. An example of another body in our solar system that has an ocean is \_\_\_\_.
- the moon of Earth
  - Europa
  - Mars
  - Saturn
23. In the scientific method, scientific theories must be \_\_\_\_.
- tested and consistently supported by observations or experiments
  - verified by the leading authorities in the field
  - consistent with previous, universally accepted scientific concepts
  - consistent with the fact that the ocean is of great age
24. Evidence suggests that the first living molecules may have formed near \_\_\_\_.
- the continents
  - subduction zones
  - the surface of the ocean
  - mineral-rich seeps on the ocean floor
25. The inner core of Earth is primarily made of \_\_\_\_.
- magnesium
  - water
  - iron
  - silicates
26. Volcanic venting of substances including water vapor is called \_\_\_\_.
- outgassing
  - fissure
  - fusion
  - condensation

27. What is the most abundant form of matter in the universe?
- water molecules
  - planets and planet-like bodies
  - dust and debris
  - hydrogen
28. Which statement is true about the formation of our solar system and planet?
- As a nebula contracts, stars are formed along the outer edges of the spinning disc of gas and dust.
  - Planets form as gases and materials condense.
  - The Big Bang occurred about 5.6 billion years ago.
  - Gaseous planets form in the innermost regions of the solar system.
29. A galaxy is a huge rotating aggregation of stars, dust, gas and other debris held together by \_\_\_\_.
- nebulae
  - gravity
  - moons
  - vapor
30. Our sun and its family of planets were formed about \_\_\_\_.
- 6,000 to 10,000 years ago
  - 5 billion years ago
  - 45 million years ago
  - 40 billion years ago
31. Life on Earth probably evolved in the ocean. Which statement supports this view?
- The cellular makeup of all living organisms depends on saline water within their cells to dissolve and transport chemicals.
  - Biosynthesis cannot occur without high concentrations of free oxygen, similar to the condition of Earth's early atmosphere and ocean.
  - In laboratory experiments, complex life formed spontaneously in a solution similar to that of Earth's early ocean.
  - The oldest fossils yet found are remnants of land-based organisms.
32. The primary physical process responsible for the formation of Earth's layers, the inner and outer core, mantle, and crust is \_\_\_\_.
- density stratification
  - radioactive decay
  - outgassing
  - mass
33. The death of a star is characterized by a massive release of energy called a \_\_\_\_.
- nebula
  - protostar
  - supernova
  - comet

34. Based on supporting evidence of the Mars “ocean” hypothesis, which statement is true?
- Mars has an ocean today.
  - Mars has an ocean, and it is probably hidden in vast caverns beneath the surface of the planet.
  - Mars may have had an ocean in the distant past, between 3.2 and 1.2 billion years ago.
  - Mars may have had an ocean until very recently.
35. The average depth of the ocean is approximately \_\_\_\_.
- 760 meters (2,500 feet)
  - 3,700 meters (12,000 feet)
  - 200 meters (650 feet)
  - 1,200 meters (4,000 feet)
36. The world ocean \_\_\_\_.
- plays a minor role in the weather and shape of landmasses of Earth
  - does not influence the way organisms live on land
  - dramatically influences weather, nurtures life, and provides crucial natural resources
  - has an average depth that represents over half of Earth's radius
37. During its initial formation by the accretion of particles, the young Earth was \_\_\_\_.
- shrouded in a thick atmosphere
  - density stratified with a core, mantle, and crust
  - likely chemically homogenous throughout
  - completely covered by an ocean
38. The oldest known fossils were discovered in northwestern Australia and resemble modern-day \_\_\_\_.
- bacteria
  - animals
  - fungi
  - viruses
39. Carbon-based residues found in rocks near Greenland suggest that the first life forms on Earth may have arisen \_\_\_\_.
- more than 3.8 billion years ago
  - at the same time as the formation of Earth
  - relatively recently - about 250,000,000 years ago
  - about 10,000 years ago
40. The ocean originated from \_\_\_\_.
- water vapor produced by cellular respiration in early living organisms
  - radioactive heating of Earth's interior, and the heating of the surface by meteorites striking and melting the outer layers of Earth
  - capture by Earth's gravity of water molecules in space
  - volcanic gases, radioactive heating of Earth's interior, and a barrage of icy comets or asteroids striking and melting the outer layers of Earth
41. Describe the general steps involved in the scientific method.

42. What is meant by a "single world ocean"?
43. Discuss the early atmosphere and how it could have lead to the evolution of life on Earth.
44. Describe the big bang theory.
45. Describe the basic processes and timeline that led to the formation of Earth and its ocean and atmosphere.

## **Answer Key**

1. True

2. True

3. True

4. False

5. True

6. True

7. True

8. False

9. True

10. False

11. c

12. b

13. a

14. c

15. d

16. b

17. d

18. d

19. a

20. d

21. b

22. b

23. a

24. d

25. c

26. a

27. d

28. b

29. b

30. b

31. a

32. a

33. c

34. c

35. b

36. c

37. c

38. a

39. a

40. d

41. The scientific method starts with a question, or a desire to understand something that has been observed or measured. A working hypothesis is formed to tentatively explain the observation. The hypothesis is tested with controlled experiments and further observations to be either verified or disproved. A hypothesis that is consistently supported by observation or experiment is advanced to the status of theory, a statement that explains the observations. Theories can evolve into larger constructs, known as laws, which summarize the observations.

42. The ocean comprises about 71% of the surface of Earth and exists as a single large continuous mass of water. The ocean has very few dependable, natural and permanent divisions. The artificial compartments we generally refer to as oceans (i.e., Pacific, Atlantic or Indian Ocean) or seas are based on either the position of the continents or on imaginary boundaries or lines such as the equator.

43. Earth's atmosphere formed as hot gases escaped from deep within the planet. This early atmosphere included gases such as carbon dioxide, methane and ammonia (note that molecular oxygen was absent in the atmosphere until about 2.2 billion years ago). Experiments have shown that organic molecules necessary for life could have formed as the dissolved compounds in the atmosphere were exposed to light, heat and electrical sparks. These energized mixtures can produce simple sugars and amino acids, proteins and nucleotides - all biologically important molecules.

44. Our universe had a beginning that is described as the big bang event. This event occurred about 13.7 billion years ago and marks the beginning of a series of events that formed our Earth, ocean and eventually allowed for the evolution of life on our planet. The big bang specifically refers to the moment when the expansion of the universe began. All of the mass and energy of the universe is thought to have been concentrated at a geometric point at the beginning of space and time.

45. Earth formed about 4.6 billion years ago through the accretion of particles orbiting in our solar system. Earth was initially molten and layers only formed once planet began to cool. Density stratification allowed the least dense elements to escape to Earth's surface and atmosphere, while the most dense elements sunk to form the internal layers of Earth, the mantle and core. The ocean and the atmosphere formed together as the planet cooled sometime between 4.4 and 3.8 billion years ago. The ocean formed as water vapor trapped in Earth's outer layers escaped to the surface via volcanic activity, a process called outgassing. This vapor cooled and condensed to form an ocean.