

**Wicander Monroe Historical Geology 7e Chapter 1
The Dynamic and Evolving Earth**

TRUE/FALSE

1. Cyanobacteria (blue-green algae) are part of the Earth's hydrosphere.

ANS: F PTS: 1

2. The oceans are part of the Earth's hydrosphere.

ANS: T PTS: 1

3. The universe is presently contracting.

ANS: F PTS: 1

4. The *red-shift* is an example of the *Doppler effect*.

ANS: T PTS: 1

5. Mercury is an example of a Jovian planet.

ANS: F PTS: 1

6. The universe is presently 98% hydrogen and helium.

ANS: T PTS: 1

7. Our solar system is part of the Andromeda Galaxy.

ANS: T PTS: 1

8. The Earth probably formed by the accretion of small bodies called planetesimals.

ANS: T PTS: 1

9. The Jovian planets (e.g., Jupiter) are mostly composed of heavy elements like uranium (U) and lead (Pb).

ANS: F PTS: 1

10. The asteroids in the asteroid belt are the remnants of a very large planet that formed early in solar system history, but broke apart by impact with another large body.

ANS: F PTS: 1

11. The Moon is an example of an asteroid that was captured by the Earth's gravitational field early in solar system history.

ANS: F PTS: 1

12. The asthenosphere is the outer layer of the Earth, which is rigid and is broken into individual plates.

ANS: F PTS: 1

13. The Earth's mean global temperature has changed significantly over the course of our planet's history.

ANS: T PTS: 1

14. The *relative geologic time scale* was largely constructed in the 20th century.

ANS: F PTS: 1

15. Radiometric dating allowed scientists to assign absolute ages to the relative geologic time scale.

ANS: T PTS: 1

16. The smallest terrestrial planet is Pluto.

ANS: F PTS: 1

17. The two types of the Earth's crust are known as lithosphere and oceanic.

ANS: F PTS: 1

18. The oceanic crust is less dense than the continental crust.

ANS: F PTS: 1

19. The mantle is composed of a rock called peridotite that is rich in iron and magnesium.

ANS: T PTS: 1

20. The solar nebula theory of the formation of the solar system accounts for the differences in composition between the terrestrial and Jovian planets.

ANS: T PTS: 1

21. According to the theory of organic evolution, all living organisms are related and they are descended, with some modifications, from organisms that lived in the past.
- ANS: T PTS: 1
22. The central thesis of the theory of organic evolution is that the same diversity of species on Earth today existed in the past.
- ANS: F PTS: 1
23. Natural selection refers to the survival of organisms that are best adapted to their environment.
- ANS: T PTS: 1
24. The most interior division of the planet Earth is the core, which is liquid at its center because of extreme pressures, but solid toward the Earth's surface.
- ANS: F PTS: 1
25. Galaxies that are moving away from us exhibit shifts in spectral lines toward the red end of the spectra.
- ANS: T PTS: 1
26. Terrestrial planets in our solar system have thick atmospheres, while the outer planets are primarily atmosphere-free.
- ANS: F PTS: 1
27. The differentiation of the Earth was simultaneous with its formation from the accretion of planetesimals.
- ANS: F PTS: 1
28. According to the principle of uniformitarianism, processes have always occurred at the same rates throughout geologic time.
- ANS: F PTS: 1
29. In the 19th century, the geologic time scale was based primarily on rock exposures and the sequence of fossils in the rock record.
- ANS: T PTS: 1
30. Radiometric dating techniques allow geologists to place events in sequence without knowing their exact ages.

ANS: F PTS: 1

MULTIPLE CHOICE

1. Mars is an example of a _____ planet.
- a. terrestrial
 - b. Jovian

ANS: A PTS: 1

2. Saturn is an example of a _____ planet.
- a. terrestrial
 - b. Jovian

ANS: B PTS: 1

3. The oceans are part of the Earth's
- a. biosphere.
 - b. hydrosphere.
 - c. lithosphere.
 - d. mesosphere.
 - e. atmosphere.

ANS: B PTS: 1

4. An explanation for some natural phenomenon that is testable and is supported by a large body of evidence (e.g., plate tectonics):
- a. hypothesis
 - b. scientific law
 - c. transgression
 - d. principle
 - e. theory

ANS: E PTS: 1

5. Cyanobacteria (blue-green algae) are part of the
- a. biosphere.
 - b. hydrosphere.
 - c. lithosphere.
 - d. mesosphere.
 - e. atmosphere.

ANS: A PTS: 1

6. The outer, rigid part of the Earth consisting of the upper mantle, oceanic crust, and continental crust; this layer is divided into plates:

- a. lithosphere
- b. asthenosphere
- c. atmosphere
- d. biosphere
- e. mesosphere

ANS: A PTS: 1

7. Part of the upper mantle that behaves as a plastic and flows:
- a. lithosphere
 - b. asthenosphere
 - c. crust
 - d. atmosphere
 - e. core

ANS: B PTS: 1

8. The inner core is
- a. solid.
 - b. liquid.
 - c. gas.

ANS: A PTS: 1

9. The outer core is
- a. solid.
 - b. liquid.
 - c. gas.

ANS: B PTS: 1

10. The principle asserting that processes operating in the present world can be used to interpret events of the past; the present is the key to the past:
- a. catastrophism
 - b. uniformitarianism
 - c. lithification
 - d. unconformity
 - e. weathering

ANS: B PTS: 1

11. Proposed the concept of natural selection:
- a. Hutton
 - b. William Smith
 - c. Darwin
 - d. Werner
 - e. Wegener

ANS: C PTS: 1

12. A mechanism accounting for differential survival and reproduction among members of a species; survival of the fittest:
- a. neptunism
 - b. stratigraphy
 - c. formation
 - d. natural selection
 - e. orogeny

ANS: D PTS: 1

13. Scientific evidence suggests that Earth formed approximately _____ ago.
- a. 4.6 trillion years
 - b. 4.6 million years
 - c. 4.6 billion years
 - d. 4600 years
 - e. 460 years

ANS: C PTS: 1

14. A combination of related parts that interact in an organized manner:
- a. system
 - b. hypothesis
 - c. theory
 - d. uniformitarianism
 - e. scientific method

ANS: A PTS: 1

15. The study of the origin and evolution of Earth, its continents, oceans, atmosphere, and life:
- a. physical geology
 - b. scientific method
 - c. cosmology
 - d. historical geology
 - e. solar nebula

ANS: D PTS: 1

16. The division of the Earth that exists below the crust and above the core is the
- a. innersphere.
 - b. lithosphere.
 - c. mantle.
 - d. convection center.
 - e. molten zone.

ANS: C PTS: 1

17. Which of the following statements about the asthenosphere is *not* true?
- a. It lies beneath the lithosphere.
 - b. It is a rigid rock layer.

- c. It behaves plastically.
- d. It acts like a lubricating layer allowing plates to move.
- e. It has the same composition as the lower mantle.

ANS: B PTS: 1

18. The ocean crust is composed mostly of
- a. granite.
 - b. peridotite.
 - c. basalt.
 - d. rhyolite.
 - e. gneiss.

ANS: C PTS: 1

19. The geologic time scale was originally based upon
- a. changes in the Earth's biota.
 - b. the theory of organic evolution.
 - c. the isotopes of minerals.
 - d. absolute ages of rocks based on radiometric age dates.
 - e. geographic mineral locations.

ANS: A PTS: 1

20. Organic evolution is supported by a multitude of evidence. It is predictive, supported by a multitude of evidence, and offers a good explanation of observed phenomena. Organic evolution, therefore, is considered a
- a. hypothesis.
 - b. law.
 - c. theory.
 - d. unifying concept.
 - e. working model.

ANS: C PTS: 1

SHORT ANSWER

1. The science of geology is divided into two broad areas: _____ geology and _____ geology.

ANS:
physical, historical

PTS: 1

2. Solar system planets are classified as either _____ or _____ planets based upon their chemical and physical properties.

ANS:
terrestrial, Jovian

PTS: 1

3. Darwin suggested that the *mechanism* by which evolution proceeds is _____.

ANS:
natural selection

PTS: 1

4. The four subsystems at the surface of the Earth are _____, _____, _____, and _____.

ANS:
atmosphere, hydrosphere, biosphere, lithosphere

PTS: 1

5. A combination of related parts that interact in an organized manner is a _____.

ANS:
system

PTS: 1

6. The Earth's age is thought by most geologists to be _____.

ANS:
4.6 billion years

PTS: 1

7. The Moon's surface was heavily cratered through the bombardment of _____.

ANS:
meteorites

PTS: 1

8. The Doppler effect suggests that the universe is _____.

ANS:

expanding

PTS: 1

9. Our solar system is part of the _____ Galaxy.

ANS:

Milky Way

PTS: 1

10. A/an _____ is an interplanetary body that is composed of loosely bound rocky and icy material.

ANS:

comet

PTS: 1

ESSAY

1. A system is a combination of related parts that interact in an organized manner. Write an essay describing how the Earth acts as a system with subsystems. What are these subsystems and how do they interact?

ANS:

The student should describe the subsystems (spheres) of Earth: atmosphere, biosphere, hydrosphere, geosphere (lithosphere, mantle, and core). He (she) should also include a discussion of how these subsystems interact.

PTS: 1

2. Write a brief essay discussing the scientific method. What are the important steps in this method? Provide specific examples of concepts that have been considered by this method and their results.

ANS:

The student should discuss the definitions of hypothesis, theory, and natural law. Especially important is the recognition that the scientific method is an iterative, pragmatic process. How does the layman's concept of the term "theory" contrast with the scientific definition of the term?

PTS: 1

3. Describe and discuss the concept of the Big Bang. What scientific evidence supports this theory? What are its limitations?

ANS:

The student should first describe the concept of the Big Bang and provide a brief history of the early universe. Scientific evidence that supports the Big Bang may include evidence that the universe is expanding, including the red shift and the Doppler effect. The student may also want to mention the expansion rate and limitations to this theory.

PTS: 1

4. Write a short essay discussing the origin and development of the early solar system. What evidence do we have for events that took place during this period?

ANS:

The student should discuss solar nebula theory, the accretion of planetesimals, and the origin of the raw materials that made up the early solar nebula. Evidence is derived from mathematical modeling of the early solar system and from materials contained within various types of meteorites.

PTS: 1

5. Compare and contrast the various planetary bodies of our solar system, including their locations and physical characteristics. Provide a detailed “travelogue” moving from the Sun to the outer parts of the solar system. Why do the physical characteristics of the planets change moving away from the Sun?

ANS:

The student should provide a brief description of the planets, asteroids, moons, and comets of our solar system. There should be a discussion of the contrasting character of the terrestrial planets and the Jovian planets. How do we get our information about these bodies? Remote sensing and analysis of samples of these bodies (meteorites and samples acquired by space missions) provide our only information about other bodies.

PTS: 1

6. Provide a brief discussion of the internal structure of the Earth. What are the physical characteristics of each of the layers? What caused the “differentiation” of the Earth?

ANS:

The student should provide a description of the internal physical and chemical layers of Earth, including the crust, mantle, inner core, outer core, lithosphere, and asthenosphere. This discussion should also include information about the internal heating mechanisms of Earth, including radioactive decay and accretional energy and how these mechanisms influenced differentiation of the original “raw material” that formed Earth.

PTS: 1

7. Provide a brief description of plate tectonic theory. How do interactions of the plates influence geologic processes? Provide specific examples.

ANS:

The student should provide a brief overview of the plate tectonic theory and recognize that plates diverge, converge, and slide past each other. The student should also recognize that these plates are fragments of the lithosphere of the Earth.

PTS: 1

8. Provide a brief discussion of the theory of organic evolution. What evidence supports this theory?

ANS:

The student should explain the concepts of organic evolution and natural selection. Evidence may include changes in fossil organisms in the rock record.

PTS: 1

9. Discuss the concept of geologic time and uniformitarianism. What is the geologic time scale?

ANS:

The student should discuss the theory of uniformitarianism, based on the premise that present-day processes have operated throughout geologic time. An important part of this discussion is the recognition that geologic time is very long, extending over billions of years. The student should recognize that geologic events occur on a variety of time scales from microseconds to millions and billions of years.

PTS: 1

10. Explain the scientific method.

ANS:

The scientific method starts with a question. Tentative explanations are called hypotheses. These hypotheses are tested to see if their predictions are valid. If one of the hypotheses is found to explain the phenomenon after repeated tests, it is proposed as a theory.

PTS: 1