CHAPTER 14—HISTORY OF LIFE

MULTIPLE CHOICE

1. Spontaneous generation has been offered as an explanation for
   a. the birth of live offspring from a mother.
   b. the germination of a seed.
   c. the appearance of maggots on rotting meat.
   d. All of the above

   ANS: C DIF: 1 OBJ: 14-1.1

2. How did Redi test the hypothesis of spontaneous generation?
   a. He placed meat in one container and left another container empty. He then observed the containers for the appearance of maggots.
   b. He placed meat in two containers and covered one of them. He then observed the containers for the appearance of maggots.
   c. He placed meat in two containers and fly eggs in one of them. He then observed the containers for the appearance of maggots.
   d. He placed adult flies in two containers, one with meat in it and one without. He then observed the containers for the appearance of maggots.

   ANS: B DIF: 1 OBJ: 14-1.2

3. What did Pasteur do in his experiments on spontaneous generation that other scientists before him had not done?
   a. He boiled the broth in his flasks.
   b. He sealed his flasks.
   c. He used curve-necked flasks and left them open.
   d. He added microorganisms to the broth before he boiled it.

   ANS: C DIF: 1 OBJ: 14-1.3

4. The age of Earth is estimated to be approximately
   a. 2 million years.
   b. 2 billion years.
   c. 2 trillion years.
   d. 4 billion years.

   ANS: D DIF: 1 OBJ: 14-2.1

5. Which of the following is *not* thought to have been a factor in the formation of Earth?
   a. Pieces of debris in space collided with Earth, thereby heating it.
   b. Pieces of debris in space added to the size of Earth.
   c. Earth was formed from debris that circled the sun as it formed.
   d. Earth was formed from the collision of two small stars.

   ANS: D DIF: 2 OBJ: 14-2.1

6. If the half-life of a radioactive isotope is 5,000 years, how much of the radioactive isotope in a specimen will be left after 10,000 years?
   a. all of it
   b. one-half of the original amount
   c. one-quarter of the original amount
   d. none of it

   ANS: C DIF: 1 OBJ: 14-2.2

7. The half-life of a radioactive isotope
   a. does not change.
   b. varies with the seasons.
   c. increases as the radioactive isotope ages.
   d. fluctuates.

   ANS: A DIF: 1 OBJ: 14-2.2

8. The age of fossils, such as those of bones, can sometimes be determined by
   a. observing their magnetism.
   b. measuring the amount of a specific radioactive isotope in the fossil bones.
   c. analyzing the DNA in the bones.
   d. observing their developmental pattern.

   ANS: B DIF: 1 OBJ: 14-2.2

9. The half-life of carbon-14 is 5,730 years. How much of an initial amount of this substance would remain after 17,190 years, which is three times its half-life?
   a. none
   b. one-half
   c. one-fourth
   d. one-eighth

   ANS: D DIF: 1 OBJ: 14-2.2

10. Isotopes are forms of the same element that differ in
    a. atomic number.
    b. number of electrons.
    c. number of neutrons.
    d. number of protons.

    ANS: C DIF: 1 OBJ: 14-2.2

11. Which of the following gases was thought by Oparin to be part of Earth's early atmosphere?
    a. oxygen
    b. ozone
    c. ammonia
    d. carbon dioxide

    ANS: C DIF: 1 OBJ: 14-2.3

12. Oparin believed that macromolecules, such as proteins, first appeared
    a. in volcanoes.
    b. in the atmosphere.
    c. in water.
    d. on iron pyrite and clay.

    ANS: C DIF: 1 OBJ: 14-2.3

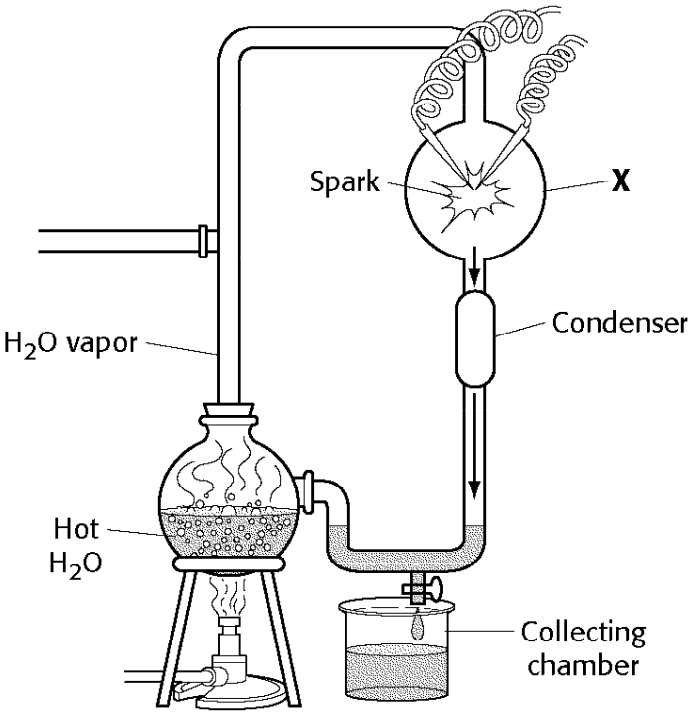
13. Miller and Urey did not use oxygen gas in their apparatus because oxygen
   a. is not essential to most forms of life.
   b. does not react with ammonia, methane, or hydrogen.
   c. would have led to the formation of microorganisms.
   d. was not believed to have been present in Earth's early atmosphere.

   ANS: D DIF: 1 OBJ: 14-2.3

14. In their experiment, Miller and Urey produced
   a. energy.
   b. microorganisms.
   c. radioactive isotopes.
   d. amino acids.

   ANS: D DIF: 1 OBJ: 14-2.3

The apparatus shown below was used by scientists in the 1950s to re-create the conditions of early Earth.



15. Refer to the illustration above. Miller and Urey's apparatus was designed to demonstrate that life on Earth might have originated from
   a. radioactive decay.
   b. simple organic molecules.
   c. extraterrestrial life.
   d. None of the above

   ANS: B DIF: 2 OBJ: 14-2.3

16. Refer to the illustration above. Water vapor in the reaction chamber labeled "X" was mixed with all of the following *except*
   a. ammonia.
   b. hydrogen.
   c. oxygen.
   d. methane.

   ANS: C DIF: 2 OBJ: 14-2.3

17. Refer to the illustration above. Gases were circulated through the apparatus. When the mixture reached the reaction chamber labeled "X," an electric spark was activated so that
    a. the gases could be removed for analysis.
    b. extra nitrogen could be added.
    c. lightning discharge through the gases could be simulated.
    d. excess carbon monoxide could be removed.

    ANS: C DIF: 2 OBJ: 14-2.3

18. Experiments conducted by Miller and Urey, and by others after them, have demonstrated that molecules important for life could have been produced in Earth's early atmosphere. These molecules include amino acids, carbohydrates, lipids, ATP, and nucleotides of DNA and RNA. Which of the following suggests how the genetic material of cells may have evolved to give instructions for the functioning and replication of cells?
    a. A spark of electricity can catalyze chemical reactions that produce proteins from DNA.
    b. Cells link amino acids together into proteins, using instructions carried in the DNA and enzymes to catalyze the reactions.
    c. RNA, like enzymes, can catalyze chemical reactions, and some RNA molecules could be self-replicating.
    d. Chains of nucleotides form when water evaporates from a solution of nucleotides.

    ANS: C DIF: 3 OBJ: 14-3.1

19. RNA
    a. was probably the first genetic molecule.
    b. can undergo natural selection and thus can evolve.
    c. probably evolved before DNA.
    d. All of the above

    ANS: D DIF: 1 OBJ: 14-3.1

20. RNA
    a. has a three-dimensional structure.
    b. is a nucleic acid.
    c. can act like an enzyme.
    d. All of the above

    ANS: D DIF: 1 OBJ: 14-3.1

21. RNA molecules can
    a. catalyze the synthesis of DNA.
    b. catalyze the synthesis of eukaryotic cells.
    c. produce complementary copies of their own nucleotide sequence.
    d. All of the above

    ANS: C DIF: 1 OBJ: 14-3.1

22. Presently, scientists think that DNA
    a. evolved before RNA.
    b. evolved simultaneously with RNA.
    c. was essential for the formation of the first cells.
    d. evolved after RNA.

    ANS: D DIF: 1 OBJ: 14-3.1

23. Scientists think that the first cells resembled modern
    a. animal cells.
    b. mitochondria.
    c. archaebacteria.
    d. chloroplasts.

    ANS: C DIF: 1 OBJ: 14-3.2

24. Scientists have inferred that the first cells were
    a. prokaryotic and autotrophic.
    b. prokaryotic and heterotrophic.
    c. eukaryotic and autotrophic.
    d. eukaryotic and heterotrophic.

    ANS: B DIF: 1 OBJ: 14-3.2

25. Which of the following is a true difference between photosynthetic organisms and chemosynthetic organisms?
    a. They differ in the source of energy they use to produce organic molecules.
    b. They differ in the source of carbon they use to produce organic molecules.
    c. Photosynthetic organisms are found on Earth today, while chemosynthetic organisms are no longer found on Earth.
    d. Photosynthetic organisms are eukaryotic, while chemosynthetic organisms are prokaryotic.

    ANS: A DIF: 2 OBJ: 14-3.3

26. The surface of Earth is protected from damaging ultraviolet light by
    a. oxygen.
    b. ozone.
    c. hydrogen.
    d. nitrogen.

    ANS: B DIF: 1 OBJ: 14-3.4

27. Which of the following is thought to have been an important early function of aerobic respiration?
    a. It enabled some early organisms to live on land.
    b. It consumed oxygen that could destroy chemicals in early organisms.
    c. It protected early organisms from ultraviolet radiation, which damages DNA.
    d. All of the above

    ANS: B DIF: 1 OBJ: 14-3.4

28. Many scientists think that early aerobic prokaryotes invaded larger cells and eventually gave rise to
    a. chloroplasts.
    b. DNA.
    c. mitochondria.
    d. ribosomes.

    ANS: C DIF: 1 OBJ: 14-3.5

COMPLETION

1. The concept of _____ states that living things could arise from nonliving things.

   ANS: spontaneous generation

   DIF: 1 OBJ: 14-1.1

2. Spallanzani demonstrated that _____ would not grow in flasks that contained broth and had been boiled and sealed.

   ANS: microorganisms

   DIF: 1 OBJ: 14-1.2

3. Spallanzani's critics claimed that he had destroyed the _____ present in the air by boiling his flasks too long.

   ANS: vital force

   DIF: 1 OBJ: 14-1.2

4. The _____ neck of Pasteur's flasks prevented microorganisms from getting into the broth in the flasks.

   ANS: curved

   DIF: 1 OBJ: 14-1.3

5. The half-life of carbon-14 is 5,730 years. One-fourth of an initial amount of this substance would remain after _____ years.

   ANS: 11,460

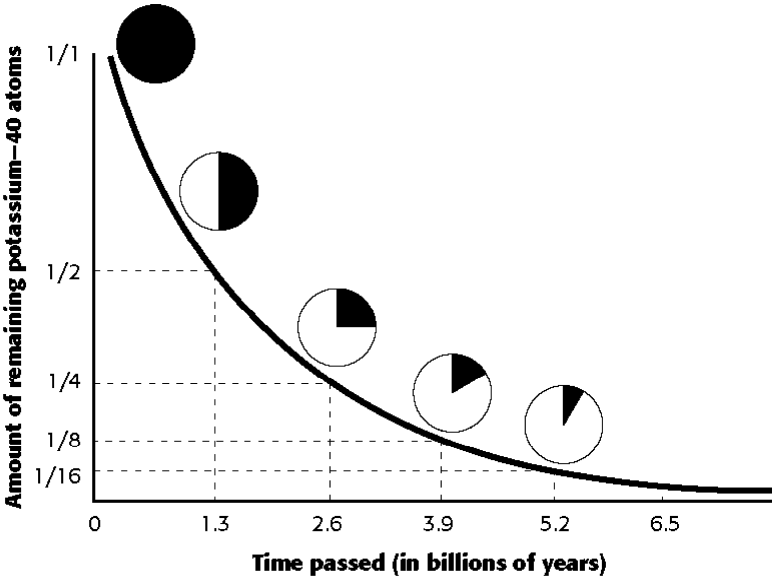
   DIF: 1 OBJ: 14-2.2

6. The period of time it takes for one-half of a radioactive isotope to decay is called its _____.

   ANS: half-life

   DIF: 1 OBJ: 14-2.2

7.



The diagram above illustrates the radioactive decay of potassium-40. The half-life of potassium-40 is about _____ billion years.

ANS: 1.3

DIF: 2 OBJ: 14-2.2

8. Protein molecules organized as a membrane form tiny structures called _____.

ANS: microspheres

DIF: 1 OBJ: 14-2.4

9. Some scientists think that small, membrane-bound structures composed of organic molecules in water may have been the first stage in the evolution of _____.

ANS: cells

DIF: 1 OBJ: 14-2.4

10. Many scientists now think that _____ was the first information-sorting molecule to form on Earth.

ANS: RNA

DIF: 1 OBJ: 14-3.1

11. The two types of _____ organisms are photosynthetic organisms and chemosynthetic organisms.

ANS: autotrophic

DIF: 1 OBJ: 14-3.3

ESSAY

1. Explain how carbon dating is used to determine the age of fossils. Write your answer in the space below.

   ANS:
   Carbon dating is based on the ratio of carbon-14 to carbon-12 in fossils. During the life of an organism, this ratio is constant. When an organism dies, the carbon-12 is stable but the carbon-14 decays at a constant rate, thereby decreasing the ratio of carbon-14 to carbon-12. By determining this ratio for a fossil, scientists can estimate how long ago the organism died.

   DIF: 2 OBJ: 14-2.2