MULTIPLE CHOICE

1. Developing a scientific understanding of a natural phenomenon typically begins by
   a. making a prediction.
   b. testing a hypothesis.
   c. proving an answer.
   d. making an observation.

   ANS: D DIF: Easy REF: 1.1 OBJ: A1
   MSC: Factual

2. The scientific method cannot be used to evaluate untestable hypotheses; what types of questions are untestable?
   a. questions about topics other than the natural world
   b. questions about the events immediately following the origin of the universe
   c. questions about the behavior of plants and animals
   d. questions whose possible answers are socially controversial

   ANS: A DIF: Difficult REF: 1.1 OBJ: A1
   MSC: Applied

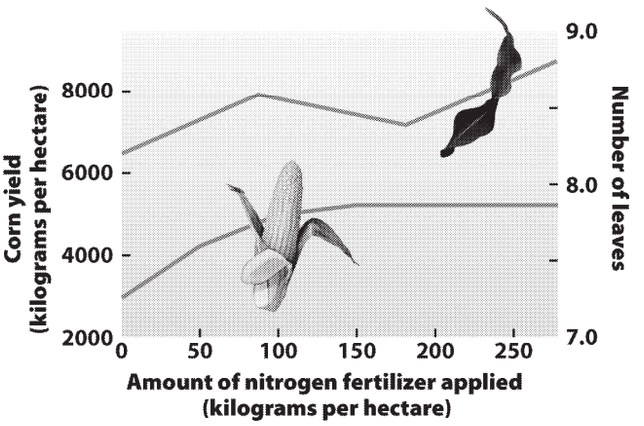
3. A medical diagnosis is a(n)
   a. observation.
   b. experiment.
   c. theory.
   d. hypothesis.

   ANS: D DIF: Medium REF: 1.1 OBJ: A2
   MSC: Applied

4. When you dial a telephone number you are
   a. making an observation.
   b. testing a hypothesis.
   c. conducting an experiment.
   d. both b and c

   ANS: D DIF: Difficult REF: 1.1 OBJ: A3
   MSC: Conceptual

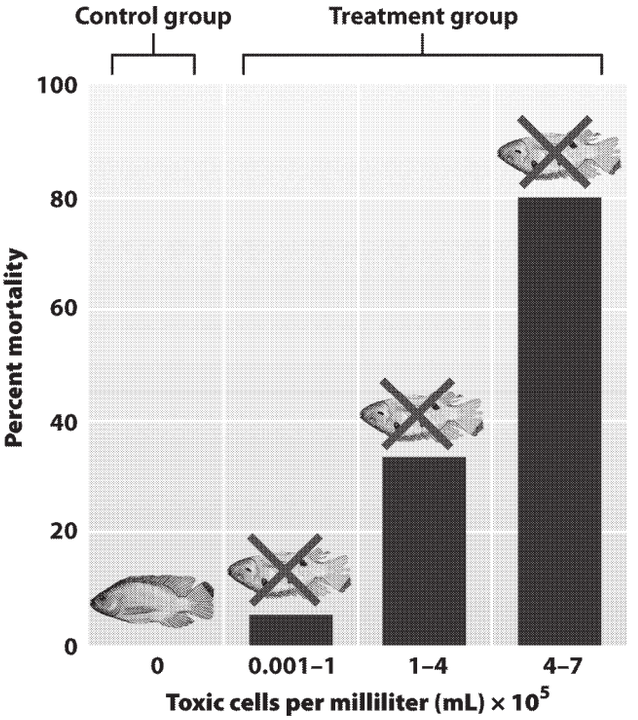
5. Which statement best summarizes the information presented in the graph below?



a. There is a strong correlation between the amount of applied fertilizer and the average number of leaves per corn plant.
b. Higher applications of fertilizer produce proportional increases in corn yield.
c. Fertilizer application is a cost-effective means of increasing farm profits.
d. Leaf growth represents energy not directed to corn production and the two variables show a negative correlation.

ANS: A DIF: Medium REF: 1.1 OBJ: A4
MSC: Applied

6. The graph below shows the 16-hour mortality resulting from exposing talapia to different concentrations of the dinoflagellate *Pfiesteria*.



Had high mortality occurred in the control group it would indicate that

a. a more robust fish species should be used; the experiment had a fundamental design flaw.
b. the talapia had an undiagnosed preexisting illness at the beginning of the experiment.
c. *Pfiesteria* was not the toxic agent responsible for the death of the fish.
d. talapia is not suitable for captive experiments.

ANS: C DIF: Medium REF: 1.1 OBJ: A4
MSC: Applied

7. Which of the following represents conducting an experiment?

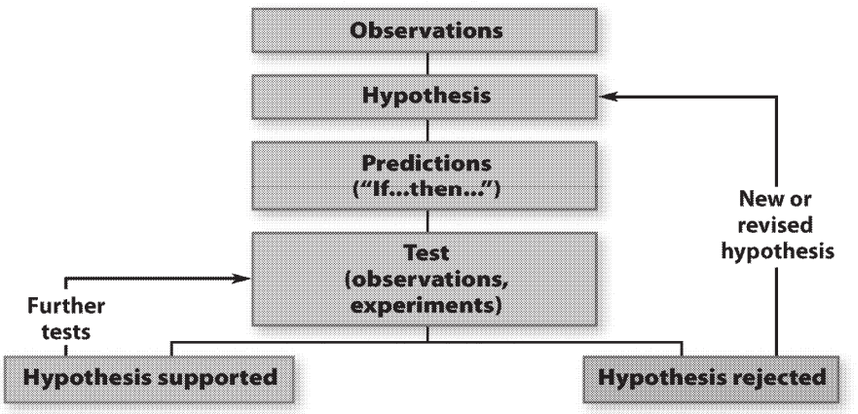
a. dialing a telephone number
b. comparing prices of computers
c. checking your midterm grades online
d. predicting the outcome of a basketball game

ANS: A DIF: Difficult REF: 1.1 OBJ: A4
MSC: Conceptual

8. Dr. Burkholder hypothesized that *Pfiesteria* was associated with the massive die-offs of estuarine fish. Her hypothesis was supported when
   a. *Pfiesteria* was shown to be capable of living within the climatic ranges of North Carolina.
   b. a predicted increase in *Pfiesteria* populations coincided with a fish die-off.
   c. new observations revealed *Pfiesteria* could kill laboratory fish.
   d. a virulent toxin was isolated from *Pfiesteria* cultures grown in the laboratory.

   ANS: B DIF: Difficult REF: 1.1 OBJ: A4
   MSC: Applied

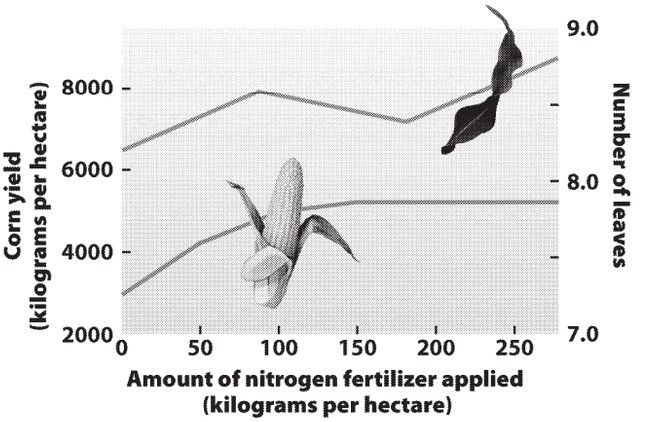
9. The figure below represents the steps in the scientific method.



   Dr. JoAnn Burkholder believed the wrong strains of *Pfiesteria* were used by independent laboratories looking for fish-killing toxin. What step in the figure above would her contention represent?
   a. observation
   b. hypothesis
   c. prediction
   d. test

   ANS: B DIF: Difficult REF: 1.1 OBJ: A4
   MSC: Conceptual

10. Which statement best summarizes the information presented in the graph below?



a. Higher applications of fertilizer produce proportional increases in corn yield.
b. Fertilizer application up to 200 kg/hectare is a cost-effective means of increasing farm yields and profits.
c. Proportional increases in irrigation are needed to maximize the growth potential of applied fertilizer.
d. Factors other than fertilizer availability can limit the yield of corn.

ANS: C DIF: Difficult REF: 1.1 OBJ: A4
MSC: Applied

11. Which of the following is an experiment?
a. reading a blood pressure gauge
b. examining an X-ray
c. taking prescription medicine
d. making a medical diagnosis

ANS: C DIF: Difficult REF: 1.1 OBJ: A4
MSC: Applied

12. What aspect of the germ theory of disease has influenced the behavior of most of the individuals in the picture below?

a. Coughing in a public place is socially unacceptable.
b. Disease-causing pathogens are communicable; they can spread from an infected individual to an uninfected individual.
c. Medications like antibiotics are a selection mechanism that ultimately strengthens the disease.
d. The pathogens that cause disease are too small to be seen without a microscope.

ANS: B DIF: Medium REF: 1.1 OBJ: A5
MSC: Applied

13. Although it seems contradictory, science cannot prove a hypothesis to be true. This is because
a. all true hypotheses will be rejected by the scientific method because they can be proven false.
b. future experiments or discoveries may provide data that refutes the hypothesis.
c. science is a human endeavor, and like all human endeavors, is limited by human understanding.
d. the scientific method is limited to examination of the natural world.

ANS: B DIF: Difficult REF: 1.1 OBJ: A5
MSC: Conceptual

14. Once supported by a predictable experimental outcome, a scientific hypothesis
a. is never reexamined.
b. still cannot be considered to have been proven true.
c. can be used to predict the outcome of all future similar events.
d. is elevated to the status of theory.

ANS: B DIF: Medium REF: 1.1 OBJ: A5
MSC: Applied

15. Which of the following statements is true?
    a. Once a hypothesis has been proposed, it can never be challenged.
    b. A valid scientific hypothesis is self-evident and does not need to be tested by experimentation.
    c. The scientific method can help people make informed medical and environmental decisions.
    d. If properly designed, experiments always prove hypotheses to be wrong.

    ANS: C DIF: Medium REF: 1.1 OBJ: A6
    MSC: Applied

16. Which of the following questions could *not* be used to develop a testable hypothesis?
    a. Does exposure to secondhand smoke affect the probability of developing lung cancer?
    b. Do organic vegetables contain harmful substances?
    c. Should everyone drink bottled water only?
    d. Does a can of vegetable juice contain more salt than the same size can of iced tea?

    ANS: C DIF: Medium REF: 1.1 OBJ: A6
    MSC: Applied

17. Some questions fall outside the realm of science; which of the following questions could *not* be answered using the scientific method?
    a. What is the function of the appendix in human beings?
    b. Why is it unethical to test newly developed drugs in animals?
    c. Why do smokers develop lung cancer more frequently than nonsmokers?
    d. Why is it so difficult to quit smoking?

    ANS: B DIF: Difficult REF: 1.1 OBJ: A6
    MSC: Applied

18. The basic unit of life is the
    a. cell.
    b. organ.
    c. organelle.
    d. tissue.

    ANS: A DIF: Easy REF: 1.2 OBJ: B1
    MSC: Factual

19. Living cells are separated from the outside environment by a flexible
    a. nucleus.
    b. membrane.
    c. cell wall.
    d. DNA circle.

    ANS: B DIF: Easy REF: 1.2 OBJ: B1
    MSC: Factual

20. Which of the following has a reproductive strategy that does *not* depend on eggs and sperm?
    a. a grasshopper
    b. a black widow spider
    c. a turtle
    d. a bacterium

    ANS: D DIF: Easy REF: 1.2 OBJ: B2
    MSC: Factual

21. Consider each of the following true statements; which statement supports the theory that all living organisms descended from one common ancestor?
    a. Bacteria have a cell wall outside the plasma membrane.
    b. Offspring resemble their parents.
    c. All living organisms use DNA as their hereditary material.
    d. Some organisms are consumers, whereas others are producers.

    ANS: C DIF: Easy REF: 1.2 OBJ: B2
    MSC: Applied

22. There is a unity in the characteristics of living organisms because they
    a. are all multicellular.
    b. are all producers.
    c. have been stable and unchanging throughout time.
    d. descended from a common ancestor.

    ANS: D DIF: Medium REF: 1.2 OBJ: B2
    MSC: Applied

23. DNA is one of the features common to all known forms of life;
    a. it forms the protective outer membrane of cells.
    b. it is produced expressly for reproduction and is found only in egg and sperm.
    c. it is the blueprint that guides the growth, development, behavior, and reproduction of all organisms.
    d. its absence in viruses is the basis for classifying them as nonliving.

    ANS: C DIF: Medium REF: 1.2 OBJ: B2
    MSC: Applied

24. The hypothesis that a common ancestor gave rise to all living organisms is strengthened by what observation?
    a. Almost all cells in all living organisms use DNA to direct their structure, function, and behavior.
    b. All living organisms use energy acquired directly from the environment or from other organisms.
    c. All living organisms reproduce.
    d. Each type of living organism adheres to the general principles of the biological hierarchy.

    ANS: A DIF: Medium REF: 1.2 OBJ: B2
    MSC: Applied

25. What characteristic is *not* shared by all living organisms?
    a. They make their own energy.
    b. They grow and develop.
    c. They evolve through time.
    d. They are composed of one or more cells.

    ANS: A DIF: Easy REF: 1.2 OBJ: B3
    MSC: Factual

26. Which organism might harvest energy from iron?
    a. a human
    b. a cricket
    c. a bacterium
    d. a goat

    ANS: C DIF: Easy REF: 1.2 OBJ: B3
    MSC: Factual

27. In which of the following objects would the energy content be most directly connected to solar energy?
    a. an apple
    b. a hamburger
    c. a slice of pizza
    d. a grilled cheese sandwich

    ANS: A DIF: Medium REF: 1.2 OBJ: B3
    MSC: Applied

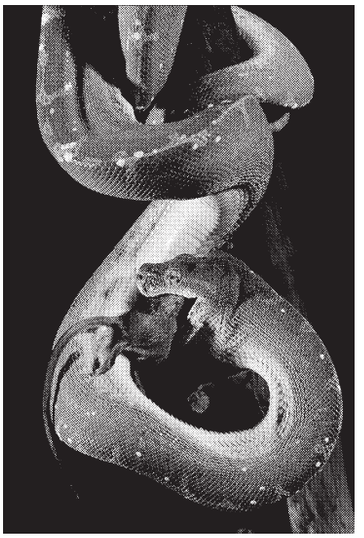
28. Which of the following statements is true?
    a. Producers obtain their energy from other organisms.
    b. Producers represent the final energy transfer in a food chain or web.
    c. Consumers obtain their energy from other organisms.
    d. Consumers represent the initial energy transfer in a food chain or web.

    ANS: C DIF: Medium REF: 1.2 OBJ: B3
    MSC: Applied

29. Which of the following statements incorrectly describes a characteristic of living organisms?
    a. All organisms require energy.
    b. All organisms consume other living things to obtain their energy.
    c. All organisms can sense and respond to their environment.
    d. All organisms reproduce.

    ANS: B DIF: Medium REF: 1.2 OBJ: B3
    MSC: Applied

30. Examine the figure below.



What best explains the motivation of the snake?

a. Mice will eat snake eggs if they are unprotected in the nest; the snake is protecting its eggs.
b. Snakes are highly territorial and attack intruders; the mouse wandered into the snake's territory.
c. The snake is a consumer; it is eating the mouse to obtain energy.
d. Any one of the above is a reasonable hypothesis; but more information is needed before the question can be answered.

ANS: C DIF: Difficult REF: 1.2 OBJ: B3
MSC: Conceptual

31. Homeostasis is the ability to detect and correct disturbances that develop within an organism; which of the following illustrates homeostasis?

a. hunger
b. thirst
c. perspiration
d. all of the above

ANS: D DIF: Easy REF: 1.2 OBJ: B4
MSC: Applied

32. All animals have the capacity to sense and respond to their environment; humans, for example,

a. can see better than any other animal.
b. can hear better than any other animal.
c. have a better sense of smell than any other animal.
d. although not the fastest or strongest animal, have a set of sensory adaptations that are entirely compatible with human biology and environment.

ANS: D DIF: Medium REF: 1.2 OBJ: B4
MSC: Conceptual

33. The repeated replanting of the seeds from wild mustards that showed unusually prolific growth of the flower buds led to what modern cruciferous plants?
    a. turnips and kolirabi
    b. kale and cabbage
    c. cauliflower and kale
    d. broccoli and cauliflower

    ANS: D DIF: Easy REF: 1.2 OBJ: B5
    MSC: Applied

34. More than one adaptive trait in the pronghorn has been influenced by the presence of predators; in addition to its great speed the pronghorn also has
    a. a four-chambered stomach.
    b. strong teeth.
    c. camouflage coloration.
    d. hollow hair.

    ANS: C DIF: Medium REF: 1.2 OBJ: B5
    MSC: Applied

35. Charles Darwin introduced the concept of adaptation, which he defined as features that
    a. help organisms survive and reproduce.
    b. allow an organism to resist the pressures of evolutionary change.
    c. allow organisms to change their environment in ways that best ensure continued survival.
    d. All of the above are aspects of the definition of adaptation.

    ANS: A DIF: Medium REF: 1.2 OBJ: B5
    MSC: Applied

36. Evolution continues to be a generally misunderstood process to many people; the best contemporary evidence of evolution is
    a. predators culling the very young, very old, and diseased individuals in a prey population.
    b. the adaptive traits that almost all living organisms display.
    c. the change in the overall genetic characteristics of a group of organisms.
    d. the existence of habitat-displaced organisms like whales and seals living in the ocean.

    ANS: C DIF: Medium REF: 1.2 OBJ: B5
    MSC: Conceptual

37. Biologists hypothesize that the now-extinct American cheetah provided the selection pressure that led to the swiftness of the pronghorn. Predict how pronghorn speed might change in the next few thousand years.
    a. Pronghorns will continue to become even faster; it's always better to run as fast as possible.
    b. Pronghorns will become slower as individuals divert energy and resources away from running and toward other features that improve fitness.
    c. Pronghorns will maintain their speed; once a characteristic is developed it's always retained.
    d. Pronghorns will maintain their speed because predators like cougars, wolves, and the coyote will remove slower individuals.

    ANS: B DIF: Difficult REF: 1.2 OBJ: B5
    MSC: Conceptual

38. Modern life often masks the struggles that have characterized human life through much of its history; survival in the past was critically dependent on the ability of humans to
    a. run faster than most human predators.
    b. solve complex problems.
    c. hear sounds at much lower intensities than other animals.
    d. sense a wider range of smells than other animals.

    ANS: B DIF: Difficult REF: 1.2 OBJ: B5
    MSC: Conceptual

39. A _____ consists of groups of different species living and interacting in a given area.
    a. biosphere
    b. population
    c. community
    d. habitat

    ANS: C DIF: Easy REF: 1.2 OBJ: C4
    MSC: Factual

40. A group of interbreeding organisms whose offspring are themselves fertile constitutes a
    a. web.
    b. biome.
    c. unit.
    d. species.

    ANS: D DIF: Easy REF: 1.2 OBJ: C4
    MSC: Factual

41. Although vaccination can provide a lifelong protection against some diseases, flu vaccines are rarely effective against next year's flu because the virus that causes flu
    a. is not alive.
    b. can evolve quickly.
    c. can change its cell membranes and block the action of the vaccine.
    d. can develop into immune bacteria and neutralize the action of the vaccine.

    ANS: B DIF: Medium REF: 1.3 OBJ: B5
    MSC: Applied

42. Multicellular organisms are constructed from many types of specialized cells. Why might this be more advantageous than being a single-celled organism?
    a. Specialized cells can do a given job better than a general-purpose cell can.
    b. Specialized cells can survive independently of the multicellular organism.
    c. Nonspecialized cells do not live as long as specialized cells.
    d. Nonspecialized cells are unable to stick together to make up a multicellular organism.

    ANS: A DIF: Medium REF: 1.3 OBJ: C2
    MSC: Conceptual

43. Which term best describes the North American rocky intertidal region shown in the photograph below?

a. a population
b. a community
c. an ecosystem
d. a biome

ANS: C DIF: Medium REF: 1.3 OBJ: C5
MSC: Conceptual

44. Which of the following sequences correctly represents the biological hierarchy of a multicellular organism?
a. cells → tissues → organs → individual
b. tissues → organs → cells → individual
c. individual → cells → organ systems → tissues
d. organ systems → organs → tissues → individual

ANS: A DIF: Easy REF: 1.4 OBJ: C3
MSC: Applied

45. An organ is defined as a body structure composed of
a. two or more molecules.
b. two or more cells.
c. two or more tissues.
d. none of the above

ANS: C DIF: Easy REF: 1.4 OBJ: C3
MSC: Factual

46. When compared to a natural system, a college campus is most similar to a(n)
    a. ecosystem.
    b. community.
    c. biome.
    d. population.

    ANS: B DIF: Medium REF: 1.4 OBJ: C4
    MSC: Applied

47. Which of the following ecological features would *not* be considered a component of an ecosystem?
    a. an individual
    b. a community
    c. a population
    d. a biome

    ANS: D DIF: Medium REF: 1.4 OBJ: C5
    MSC: Conceptual

48. Land biomes are most commonly defined by
    a. their food webs.
    b. the dominant animal life in them.
    c. the dominant plant life in them.
    d. the combination of dominant plant and animal life in them.

    ANS: C DIF: Easy REF: 1.4 OBJ: C6
    MSC: Factual

49. Which of the following statements is true?
    a. Ecosystems are composed of one or more biomes.
    b. Communities are composed of one or more ecosystems.
    c. The biosphere includes all life forms and the spaces where they live.
    d. The biosphere is an intermediate classification that falls between ecosystems and biomes.

    ANS: C DIF: Medium REF: 1.4 OBJ: C6
    MSC: Factual

50. Microbiologists quickly responded to the paper by Dr. Wolfe-Simons claiming to have discovered organisms using arsenic to construct their DNA; one of the most challenging criticisms involved
    a. the researcher's inability to account for arsenic's toxicity to other organisms.
    b. publishing the paper prior to the conventional peer review.
    c. the preparation of the bacterial DNA using nonconventional protocols.
    d. the lack of comparative information on closely related bacteria within the Halomonadacea family.

    ANS: C DIF: Medium REF: Biology in the News
    OBJ: A4 MSC: Factual

COMPLETION

1. Biology is the scientific study of _____.

    ANS: life

    DIF: Easy REF: Introduction OBJ: A1 MSC: Factual

2. The scientific method begins with _____.

   ANS: observations

   DIF: Easy REF: 1.1 OBJ: A1 MSC: Factual

3. The observation that polar ice floes are thinning or melting much earlier each spring than they did 20 years ago is an example of a scientific _____.

   ANS: fact

   DIF: Easy REF: 1.1 OBJ: A1 MSC: Applied

4. In the scientific method, observations are followed most often by_____ and then _____.

   ANS: hypotheses; experiments

   DIF: Easy REF: 1.1 OBJ: A2 MSC: Factual

5. Having first developed a _____, scientists can then propose testable predictions.

   ANS: hypothesis

   DIF: Easy REF: 1.1 OBJ: A2 MSC: Applied

6. Experimentation is the primary means that verifies or refutes the _____ made by a hypothesis.

   ANS: predictions

   DIF: Medium REF: 1.1 OBJ: A4 MSC: Applied

7. The genetic material used for reproduction by those organisms conventionally considered to be living is _____.

   ANS: DNA

   DIF: Medium REF: 1.2 OBJ: B2 MSC: Applied

8. Plants convert the energy in _____ into energy-rich substances using a process called photosynthesis.

   ANS: sunlight

   DIF: Easy REF: 1.2 OBJ: B3 MSC: Factual

9. Plants and animals need a variety of resources to carry out and maintain life processes; the most important is _____.

   ANS: energy

   DIF: Medium REF: 1.2 OBJ: B3 MSC: Applied

10. Living organisms must be able to sense and respond to both their internal and external _____ in order to survive.

    ANS: environments

    DIF: Medium REF: 1.2 OBJ: B4 MSC: Applied

11. Advantageous features that evolve over time and help an organism survive or reproduce are called _____.

    ANS: adaptations

    DIF: Easy REF: 1.2 OBJ: B5 MSC: Factual

12. Through the process of _____, a group of organisms can develop new characteristics over time.

    ANS: evolution

    DIF: Easy REF: 1.2 OBJ: B5 MSC: Factual

13. The DNA of all living things is functionally organized into discrete segments called _____ that provide the directions for a specific genetic character.

    ANS: genes

    DIF: Easy REF: 1.3 OBJ: B2 MSC: Factual

14. Because the California sea lions that live along the Pacific coast freely migrate and regularly interbreed with one another biologists classify the group as a _____.

    ANS: population

    DIF: Medium REF: 1.4 OBJ: C4 MSC: Applied

15. New medications undergo extensive human testing before receiving FDA approval; these tests represent an experiment and variations in the dosage given to participants represents the _____.

    ANS: independent variable

    DIF: Medium REF: 1.5 OBJ: C5 MSC: Applied

16. The discovery that bacteria living in Mono Lake had replaced the phosphorus in certain biomolecules with _____ has challenged long-held assumptions about the chemical nature of life.

    ANS: arsenic

    DIF: Easy REF: Biology in the News OBJ: A1
    MSC: Applied

TRUE/FALSE

1. A scientific hypothesis must be testable; if not, science cannot evaluate it.

   ANS: T DIF: Medium REF: 1.1 OBJ: A2
   MSC: Applied

2. A good hypothesis is easy to prove.

   ANS: F DIF: Medium REF: 1.1 OBJ: A3
   MSC: Applied

3. Hypotheses can be rejected or supported by experiments, or, in some instances, new observations.

   ANS: T DIF: Medium REF: 1.1 OBJ: A4
   MSC: Conceptual

4. Once experimental data verifies a prediction the hypothesis is considered proven.

   ANS: F DIF: Medium REF: 1.1 OBJ: A5
   MSC: Conceptual

5. DNA is an example of the molecular level of biological organization.

   ANS: T DIF: Easy REF: 1.2 OBJ: B2
   MSC: Factual

6. New cells are created when existing cells divide; immediately after division, every cell of every known living organism will contain DNA.

   ANS: T DIF: Medium REF: 1.2 OBJ: B2
   MSC: Applied

7. The term *autotroph* can be interchanged with the term *producer*; both terms refer to organisms that obtain energy from the nonliving part of their environment.

   ANS: T DIF: Easy REF: 1.2 OBJ: B3
   MSC: Factual

8. All living organisms sense their environment and respond to it.

   ANS: T DIF: Easy REF: 1.2 OBJ: B4
   MSC: Factual

9. Some bacteria can sense direction using magnetic particles in their cells.

   ANS: T DIF: Easy REF: 1.2 OBJ: B4
   MSC: Factual

10. Those organisms classified as consumers capture their energy directly from the sun.

    ANS: F DIF: Easy REF: 1.3 OBJ: B3
    MSC: Factual

11. Polar bears are white, which makes them difficult to see as they stalk seals; their white fur is an example of an adaptation.

    ANS: T DIF: Medium REF: 1.3 OBJ: B5
    MSC: Applied

12. A molecule is constructed when two or more atoms become bonded to one another.

    ANS: T DIF: Easy REF: 1.3 OBJ: C1
    MSC: Factual

13. The organs that constitute an organ system often work cooperatively to maintain homeostasis.

    ANS: T DIF: Medium REF: 1.3 OBJ: C3
    MSC: Applied

14. Because the brain is constructed from nerve cells it is considered an organ.

    ANS: F DIF: Difficult REF: 1.3 OBJ: C3
    MSC: Applied

15. Living organisms are intimately connected to the environments where they live. Such an association is called a biome, and a forest is a good example.

    ANS: F DIF: Medium REF: 1.3 OBJ: C6
    MSC: Applied

16. Phosphorus is considered an essential element for life; if the bacteria found in Mono Lake actually incorporate arsenic into their DNA, this assessment will need to be reevaluated.

    ANS: T DIF: Medium REF: Biology in the News
    OBJ: B5 MSC: Applied