

Chapter 1: The Nature of Science and the Characteristics of Life

MULTIPLE CHOICE

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

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

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

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

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

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

4. Which of the following questions could *not* be used to develop a testable hypothesis?
- Does exposure to second-hand smoke affect the probability of developing lung cancer?
 - Do organic vegetables contain harmful substances?
 - Should everyone drink bottled water only?
 - 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: Applied

5. A medical diagnosis is
- an observation.
 - an experiment.
 - a theory.
 - a hypothesis.

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

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

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

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

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

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

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

9. Which of the following represents conducting an experiment?
- dialing a telephone number
 - comparing prices of computers
 - checking your midterm grades online
 - predicting the outcome of a basketball game

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

10. When you dial a telephone number you are
- making an observation.
 - testing a hypothesis.
 - conducting an experiment.
 - b and c above

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

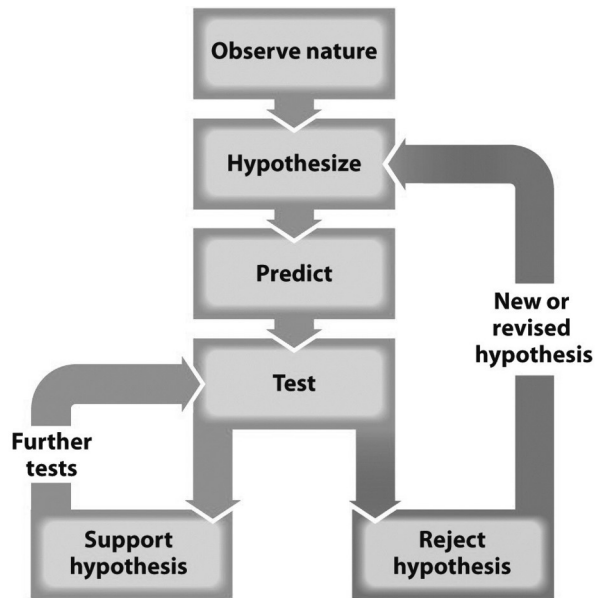
11. Dr. Burkholder hypothesized that *Pfiesteria* was associated with the massive die-offs of estuarine fish. Her hypothesis was supported when
- Pfiesteria* was shown to be capable of living within the climatic ranges of North Carolina.
 - a predicted increase in *Pfiesteria* populations coincided with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

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

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

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

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



Dr. JoAnn Burkholder believes 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: Conceptual

14. The basic unit of life is the

- a. cell.
- b. organ.
- c. organelle.
- d. tissue.

ANS: A

DIF: Easy

REF: 1.2

OBJ: Factual

15. 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: Factual

16. 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: Factual

17. 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: Factual

18. 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: Applied

19. 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: Factual

20. 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: Factual

21. Consider each of the following true statements; which statement supports the theory that all living organisms descended from one common ancestor?
- a. Viruses have a protein coat.
 - b. Offspring resemble their parents.
 - c. All living organisms use DNA as their hereditary material.
 - d. Some organisms are consumers, while others are producers.

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

22. 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: Factual

23. Charles Darwin introduced the concept of adaptation, which he defined as features
- a. that help organisms survive and reproduce.
 - b. that allow an organism to resist the pressures of evolutionary change.
 - c. that 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: Applied

24. 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. while 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: Conceptual

25. 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: Applied

26. 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: Applied

27. 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: Applied

28. 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: Applied

29. 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 web.
 - c. Consumers obtain their energy from other organisms.
 - d. Consumers represent the initial energy transfer in a food web.

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

30. Examine the figure below.



What best explains why the young woman is drinking after her exercise session?

- a. Exercise creates body heat, which needs to be eliminated.
- b. Cold water cools the body and restores the temperature balance—a process known as homeostasis.
- c. The beverage is most likely a sugar-sweetened soft drink; sugar replenishes the energy lost during exercise.
- d. Sweating to eliminate excess heat is a source of water loss, which must be replenished if homeostasis is to be maintained.

ANS: D DIF: Difficult REF: 1.2 OBJ: Conceptual

31. 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: Conceptual

32. Scientists disagree whether viruses
- a. should be classified as living organisms.
 - b. reproduce.
 - c. contain genetic material.
 - d. have nuclei and organelles.

ANS: A

DIF: Easy

REF: 1.3

OBJ: Factual

33. When compared to living organisms, viruses display several unusual features; one of the most striking is that
- a. viruses do not evolve.
 - b. viral reproduction utilizes a cloning strategy that is independent of DNA.
 - c. viruses utilize both DNA and RNA in their biochemistry.
 - d. viruses are not constructed from cells.

ANS: D

DIF: Easy

REF: 1.3

OBJ: Factual

34. 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: Applied

35. 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: Factual

36. 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: Factual

37. 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: Factual

38. When compared to a natural system, a college campus is most similar to
- a. an ecosystem.
 - b. a community.
 - c. a biome.
 - d. a population.

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

39. 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: Conceptual

40. 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: Factual

41. Which of the following statements is true?
- a. Since they do not consume their prey, decomposers are usually not included within the food web for a typical ecosystem.
 - b. Ecosystems create the energy needed for their continued existence; the process can be represented using a food web.
 - c. Organisms that eat plants do not use energy.
 - d. Energy generally flows in one direction through the biosphere.

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

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: 1.4

OBJ: Conceptual

43. 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: 1.4

OBJ: Conceptual

44. Ecologists use food webs to diagrammatically or verbally represent

- a. how organisms in an ecosystem select their mates during reproduction.
- b. how energy moves between the various members of the ecosystem.
- c. which species can interbreed with other species.
- d. the organization of an organism.

ANS: B

DIF: Easy

REF: 1.5

OBJ: Factual

45. Most ecosystems experience energy losses that equal energy gain; the quantity of incoming solar energy is equal to the quantity of outgoing _____ energy.

- a. light
- b. sound
- c. heat
- d. ultraviolet

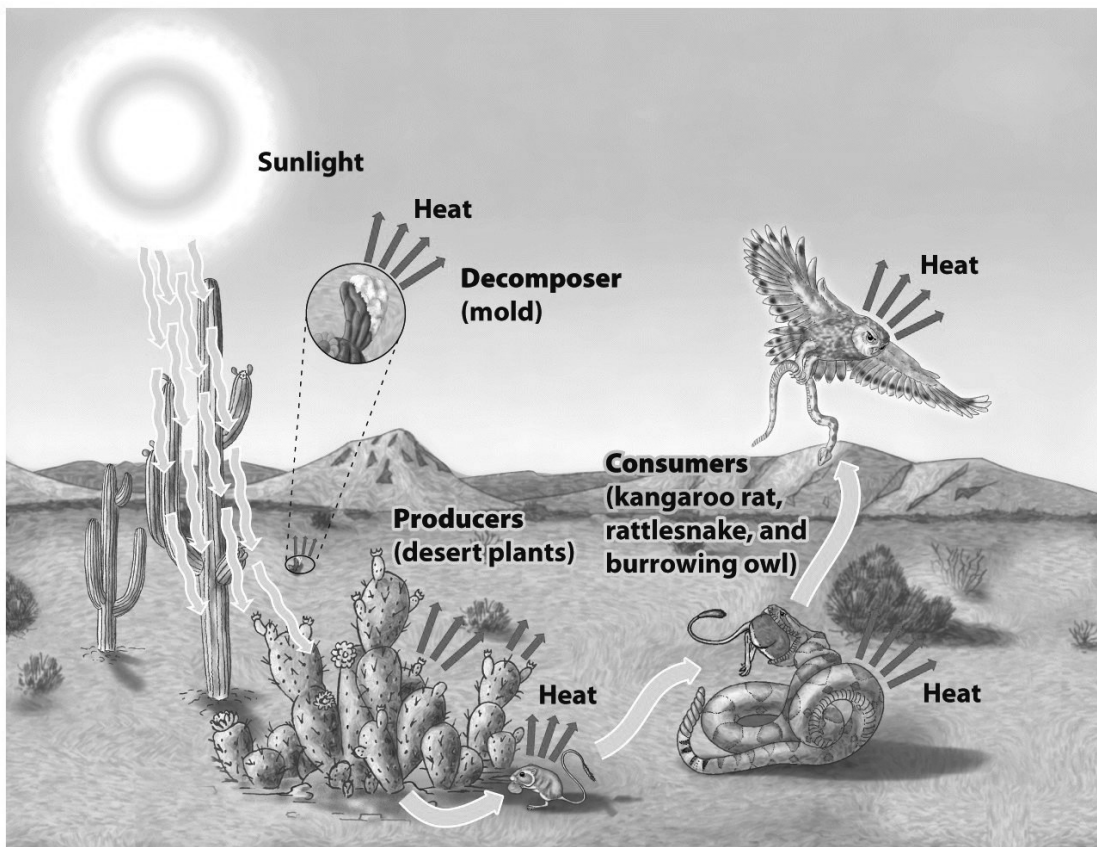
ANS: C

DIF: Medium

REF: 1.5

OBJ: Conceptual

46. The figure below of a desert ecosystem illustrates the interdependency of natural systems.



What component, if removed, would have the most immediate disruptive effect on the system?

- a. sunlight
- b. producers
- c. consumers
- d. decomposers

ANS: A DIF: Difficult REF: 1.5 OBJ: Conceptual

47. Stanley Miller simulated Earth's ancient atmosphere and exposed it to "lightning" to test whether
- a. DNA could be produced from RNA.
 - b. life could have evolved on planets other than Earth.
 - c. the chemical molecules characteristic of life could have arisen independently of living organisms.
 - d. cells could tolerate an exposure to electricity.

ANS: C DIF: Medium REF: Science Toolkit
OBJ: Applied

48. Although rare, rock fragments of Mars have reached earth after having been blown into space during meteorite impacts, and could possibly have transported organisms like nanobacteria with them. What type of organism would support this hypothesis?
- a. organisms whose overall dimensions were smaller than most cellular components
 - b. organisms that used a molecule very different from DNA during their reproduction
 - c. organisms that were simultaneously producers and consumers
 - d. organisms that resisted decomposition following death.

ANS: B DIF: Difficult REF: Biology in the News
OBJ: Conceptual

COMPLETION

1. Biology is the scientific study of _____.

ANS: life

DIF: Easy REF: introduction OBJ: Factual

2. The scientific method begins with _____.

ANS: observations

DIF: Easy REF: 1.1 OBJ: Factual

3. In the scientific method observations are followed most often by _____ and then _____.

ANS: hypotheses; experiments

DIF: Easy REF: 1.1 OBJ: Factual

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

ANS: hypothesis

DIF: Easy REF: 1.1 OBJ: Factual

5. Experimentation is the primary means that verify or refute the _____ made by a hypothesis.

ANS: predictions

DIF: Medium REF: 1.1 OBJ: Applied

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

ANS: sunlight

DIF: Easy REF: 1.2 OBJ: Factual

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

ANS: adaptations

DIF: Easy REF: 1.2 OBJ: Factual

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

ANS: evolution

DIF: Easy REF: 1.2 OBJ: Factual

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

ANS: DNA

DIF: Medium REF: 1.2 OBJ: 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: Applied

11. 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: Applied

12. Because the distinction between life and nonlife is an arbitrary one, not all biologists agree on what things should be considered living; one group, the _____, appears to be right at the boundary between life and nonlife.

ANS: viruses

DIF: Medium REF: 1.3 OBJ: Applied

13. A _____ is constructed from a molecule of genetic material contained within a capsule of protein.

ANS: virus

DIF: Medium REF: 1.3 OBJ: Applied

14. A _____ is a group of individuals belonging to the same species.

ANS: population

DIF: Easy REF: 1.4 OBJ: Factual

15. In the biosphere energy moves from the sun first to producers, then to consumers, and then to _____.

ANS: decomposers

DIF: Easy REF: 1.5 OBJ: Factual

TRUE/FALSE

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

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

2. A good hypothesis is easy to prove.

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

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

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

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

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

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

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

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

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

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

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

8. Not all living things obtain their energy from the sun, iron can be an energy source for some organisms.

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

9. 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: Applied

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

ANS: F DIF: Difficult REF: 1.2 OBJ: Applied

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

ANS: F DIF: Easy REF: 1.5 OBJ: Factual

12. Organisms classified as decomposers challenge the stability of ecosystems by prematurely removing organisms directly responsible for the flow of energy.

ANS: F DIF: Medium REF: 1.5 OBJ: Applied