

**CHAPTER 2—SCIENCE, MATTER, ENERGY, AND SYSTEMS**

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**MULTIPLE CHOICE**

1. In 1963, Bormann and Likens compared the output of two river valleys, one forested and the other clear cut. What were their findings?
- The deforested valley had higher water flow and a decrease in nutrient loss.
  - The forested valley had higher water flow and a decrease in nutrient loss.
  - The forested valley had lower water flow and increase in nutrient loss.
  - The deforested valley had lower water flow and increase in nutrient loss.
  - The deforested valley had higher water flow and increase in nutrient loss.

ANS: E                   PTS: 1

TOP: Core Case Study: How Do Scientists Learn About Nature? Experimenting with a Forest

KEY: Bloom's: Remember

2. What is the definition of a scientific hypothesis?
- A simulation of a system being studied
  - A possible explanation for an observation or experimentation
  - The data needed to answer a question
  - Procedures carried out under controlled conditions to gather information
  - A widely accepted theory

ANS: B                   PTS: 1

TOP: 2-1 What Do Scientists Do?

KEY: Bloom's: Remember

NOT: Modified

3. When an overwhelming body of observations and measurements supports a scientific hypothesis or group of related hypotheses, it becomes a(n) \_\_\_\_.
- hypothesis
  - scientific law
  - scientific variable
  - scientific theory
  - conclusion

ANS: D                   PTS: 1

TOP: 2-1 What Do Scientists Do?

KEY: Bloom's: Remember

4. What is a well-tested and widely accepted description of what scientists find happening repeatedly in nature in the same way?
- theory
  - scientific law
  - hypothesis
  - conclusion
  - model

ANS: B                   PTS: 1

TOP: 2-1 What Do Scientists Do?

KEY: Bloom's: Remember

NOT: Modified

5. What is the correct order of applying the scientific process to a problem?
- hypothesis–question–observation–experimentation–conclusion–analysis
  - hypothesis–conclusion–question–observation–experimentation–analysis
  - observation–hypothesis–conclusion–experimentation–analysis–question
  - observation–question–hypothesis–experimentation–analysis–conclusion

e. hypothesis–experimentation–observation–analysis–question–conclusion

ANS: D                   PTS: 1                   TOP: 2-1 What Do Scientists Do?  
KEY: Bloom's: Remember

6. Which of the following is an example of an organic compound?
- H<sub>2</sub>O
  - NaCl
  - H<sub>2</sub>SO<sub>4</sub>
  - N<sub>2</sub>O
  - CH<sub>4</sub>

ANS: E                   PTS: 1  
TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?  
KEY: Bloom's: Understand                   NOT: Modified

7. Complex carbohydrates are a type of \_\_\_\_.
- lipid
  - chemical formula
  - monomer
  - protein
  - organic polymer

ANS: E                   PTS: 1  
TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?  
KEY: Bloom's: Remember                   NOT: New

8. What is the distinct piece of DNA containing instructions for making proteins?
- chromosome
  - nucleotide
  - amino acid
  - cell membrane
  - hydrocarbon

ANS: C                   PTS: 1  
TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?  
KEY: Bloom's: Remember

9. What is the fundamental structural and functional unit of life?
- atom
  - macromolecule
  - DNA
  - cell
  - organism

ANS: D                   PTS: 1  
TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?  
KEY: Bloom's: Remember

10. Thousands of genes make up a single \_\_\_\_.
- chromosome
  - DNA
  - cell nucleus
  - trait
  - organism

ANS: A                   PTS: 1  
TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?  
KEY: Bloom's: Remember                   NOT: New

11. Which statement is an example of a chemical change?
- Confetti is cut from pieces of paper.
  - Water evaporates from a lake.
  - Ice cubes are formed in the freezer.
  - A plant converts carbon dioxide into carbohydrates.
  - A tree is cut down in the forest.

ANS: D                   PTS: 1  
TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?  
KEY: Bloom's: Apply                   NOT: Modified

12. Radioactive decay is best characterized as a type of \_\_\_\_.
- physical change
  - nuclear change
  - chemical change
  - chemical decay
  - organic change

ANS: B                   PTS: 1  
TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?  
KEY: Bloom's: Remember                   NOT: New

13. What law states that when matter undergoes a physical or chemical change, no atoms are created or destroyed?
- The second law of thermodynamics
  - The law of conservation of matter
  - The first law of thermodynamics
  - The atomic exchange law
  - The law of conservation of energy

ANS: B                   PTS: 1  
TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?  
KEY: Bloom's: Remember                   NOT: New

14. Electromagnetic energy travels in \_\_\_\_.
- waves
  - packets
  - nodes
  - modules
  - chunks

ANS: A                   PTS: 1  
TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?  
KEY: Bloom's: Remember                   NOT: New

15. Nuclear \_\_\_\_ occurs when two nuclei are forced together.
- decay
  - fission
  - dissipation
  - fusion
  - equilibrium

ANS: D                    PTS: 1  
TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?  
KEY: Bloom's: Remember                    NOT: New

16. Matter is anything that \_\_\_\_.
- has mass and takes up space
  - has the capacity to do work
  - can be changed in form
  - can produce change
  - moves mass

ANS: A                    PTS: 1  
TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?  
KEY: Bloom's: Remember

17. What is the most basic building block of matter?
- molecules
  - compounds
  - ions
  - atoms
  - minerals

ANS: D                    PTS: 1  
TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?  
KEY: Bloom's: Remember                    NOT: Modified

18. Fundamental types of matter that have unique sets of properties and cannot be broken down into simpler substances by chemical means are called \_\_\_\_.
- mixtures
  - compounds
  - isotopes
  - elements
  - atoms

ANS: D                    PTS: 1  
TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?  
KEY: Bloom's: Remember

19. Which substance is a compound?
- water
  - oxygen
  - nitrogen
  - hydrogen
  - carbon

ANS: A                    PTS: 1  
TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?  
KEY: Bloom's: Understand                    NOT: Modified

20. Protons, neutrons, and electrons are all \_\_\_\_.
- forms of energy
  - equal in mass
  - subatomic particles
  - negative ions

e. charged particles

ANS: C PTS: 1

TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?

KEY: Bloom's: Remember

21. The atomic number is the number of \_\_\_\_.
- atoms in a molecule
  - protons in an atom
  - neutrons in a molecule
  - electrons in an atom
  - protons, electrons, and neutrons in an atom

ANS: B PTS: 1

TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?

KEY: Bloom's: Remember

22. The mass number of an atom is equal to the sum of the \_\_\_\_.
- neutrons and isotopes
  - neutrons and electrons
  - neutrons and protons
  - protons and electrons
  - ions and isotopes

ANS: C PTS: 1

TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?

KEY: Bloom's: Remember

23. Isotopes are forms of an element that differ from one another by having different \_\_\_\_.
- atomic numbers
  - numbers of electrons
  - numbers of protons
  - mass numbers
  - electrical charges

ANS: D PTS: 1

TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?

KEY: Bloom's: Remember

24. An ion has a net positive or negative \_\_\_\_.
- proton
  - isotope
  - charge
  - acid
  - electron

ANS: C PTS: 1

TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?

KEY: Bloom's: Remember

NOT: New

25. What describes the measurement of the concentration of hydrogen ions compared to the concentration of hydroxide ions in a solution?
- ionization
  - pH
  - alkalinity

- d. covalent bonding
- e. isotope

ANS: B                    PTS: 1

TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?

KEY: Bloom's: Remember

26. Fossil fuels are best characterized as a type of \_\_\_\_.
- a. atomic particle
  - b. renewable energy
  - c. nonrenewable energy
  - d. electromagnetic energy
  - e. thermal energy

ANS: C                    PTS: 1

TOP: 2-3 What is energy and what happens when it undergoes change?

KEY: Bloom's: Remember                    NOT: New

27. High-quality energy can best be characterized as \_\_\_\_.
- a. fossilized
  - b. pure
  - c. electromagnetic
  - d. kinetic
  - e. concentrated

ANS: E                    PTS: 1

TOP: 2-3 What Is Energy and What Happens When It Undergoes Change?

KEY: Bloom's: Remember                    NOT: New

28. Which law states that no energy can be created or destroyed?
- a. The first law of thermodynamics
  - b. The second law of thermodynamics
  - c. The law of conservation of matter
  - d. The environmental exchange law
  - e. The law of homeostasis

ANS: A                    PTS: 1

TOP: 2-3 What Is Energy and What Happens When It Undergoes Change?

KEY: Bloom's: Remember                    NOT: New

29. Energy efficiency refers to \_\_\_\_.
- a. how much energy we use
  - b. how much energy is wasted
  - c. how much heat is produced
  - d. getting more work out of the energy we use
  - e. getting more energy out of our work

ANS: D                    PTS: 1

TOP: 2-3 What Is Energy and What Happens When It Undergoes Change?

KEY: Bloom's: Remember                    NOT: New

30. What is an example of low-quality energy?
- a. electricity
  - b. heat in the ocean
  - c. nuclear fission

- d. gasoline
- e. food

ANS: B                      PTS: 1

TOP: 2-3 What Is Energy and What Happens When It Undergoes Change?

KEY: Bloom's: Remember

31. What percentage of the energy used to produce food for living organisms, and to heat the earth, comes from the sun?
- a. 10
  - b. 29
  - c. 49
  - d. 79
  - e. 99

ANS: E                      PTS: 1

TOP: 2-3 What Is Energy and What Happens When It Undergoes Change?

KEY: Bloom's: Remember

32. What does the first law of thermodynamics tell us?
- a. Doing work always creates heat.
  - b. Altering matter is the best source of energy.
  - c. Energy cannot be recycled.
  - d. Energy is neither created nor destroyed.
  - e. Energy cannot be converted.

ANS: D                      PTS: 1

TOP: 2-3 What Is Energy and What Happens When It Undergoes Change?

KEY: Bloom's: Remember

33. The matter and energy laws tell us that we can recycle \_\_\_\_.
- a. both matter and energy
  - b. neither matter nor energy
  - c. matter but not energy
  - d. energy but not matter
  - e. nothing and everything

ANS: C                      PTS: 1

TOP: 2-3 What Is Energy and What Happens When It Undergoes Change?

KEY: Bloom's: Remember                      NOT: Modified

34. The energy "lost" by a system is \_\_\_\_.
- a. converted into an equal amount of matter
  - b. equal to the energy the system creates
  - c. converted to lower-quality energy
  - d. returned to the system eventually
  - e. converted to higher-quality energy

ANS: C                      PTS: 1

TOP: 2-3 What Is Energy and What Happens When It Undergoes Change?

KEY: Bloom's: Analyze                      NOT: Modified

35. Scientists classify energy as either \_\_\_\_.
- a. chemical or physical
  - b. kinetic or mechanical

- c. potential or mechanical
- d. potential or kinetic
- e. chemical or kinetic

ANS: D                      PTS: 1

TOP: 2-3 What Is Energy and What Happens When It Undergoes Change?

KEY: Bloom's: Understand

36. Which of the following represents kinetic energy?
- a. water in a reservoir behind a dam
  - b. a rock held in your hand
  - c. chemical energy stored in food
  - d. water in a stream
  - e. light from the sun

ANS: D                      PTS: 1

TOP: 2-3 What Is Energy and What Happens When It Undergoes Change?

KEY: Bloom's: Remember                      NOT: New

37. Heat is best characterized as a kind of \_\_\_\_ energy.
- a. light
  - b. potential
  - c. kinetic
  - d. nuclear
  - e. low

ANS: C                      PTS: 1

TOP: 2-3 What Is Energy and What Happens When It Undergoes Change?

KEY: Bloom's: Remember                      NOT: New

38. Scientists estimate that about \_\_\_\_\_ of the energy used in the United States is unavoidably wasted.
- a. 5%
  - b. 18%
  - c. 55%
  - d. 84%
  - e. 96%

ANS: D                      PTS: 1

TOP: 2-3 What Is Energy and What Happens When It Undergoes Change?

KEY: Bloom's: Remember                      NOT: New

39. Energy can be formally defined as \_\_\_\_.
- a. the random motion of molecules
  - b. the ability to do work and transfer heat
  - c. a force that is exerted over some distance
  - d. the movement of molecules
  - e. the loss of matter

ANS: B                      PTS: 1

TOP: 2-3 What Is Energy and What Happens When It Undergoes Change?

KEY: Bloom's: Understand

40. Which of the following best illustrates potential energy?
- a. the wind blowing
  - b. water in a stream



- c. steam
- d. a car at the top of a hill
- e. electricity

ANS: D                      PTS: 1

TOP: 2-3 What Is Energy and What Happens When It Undergoes Change?

KEY: Bloom's: Apply                                      NOT: Modified

41. Time delays in feedback systems allow changes in the environment to build slowly until the changes reach a(n) \_\_\_\_.
- a. synergy point
  - b. input stage
  - c. throughput
  - d. tipping point
  - e. bioaccumulation point

ANS: D                      PTS: 1

TOP: 2-4 What Are Systems and How Do They Respond to Change?

KEY: Bloom's: Remember

42. What are two or more processes interacting such that the combined effect is greater than the sum of the individual effects?
- a. homeostasis
  - b. synergistic interaction
  - c. negative feedback
  - d. entropy
  - e. time delay

ANS: B                      PTS: 1

TOP: 2-4 What Are Systems and How Do They Respond to Change?

KEY: Bloom's: Remember

43. A community knows the effects of chemical X when it is used alone. They also know the same for chemical Z, so they set safe limits for use for both chemicals. When the chemicals are released at safe levels on the same day, there is a massive fish kill. What is the most likely explanation?
- a. homeostasis
  - b. synergistic interaction
  - c. negative feedback
  - d. positive feedback
  - e. entropy

ANS: B                      PTS: 1

TOP: 2-4 What Are Systems and How Do They Respond to Change?

KEY: Bloom's: Apply

44. Human events that affect the environment are generally characterized by \_\_\_\_.
- a. predictability as a result of population size
  - b. many experiences leading to accurate generalizations
  - c. long delays between events and responses
  - d. obvious and immediate feedback
  - e. negative feedback

ANS: C                      PTS: 1

TOP: 2-4 What Are Systems and How Do They Respond to Change?

KEY: Bloom's: Analyze                                      NOT: Modified

45. What is considered to be the most essential component of a system?
- throughputs
  - DNA
  - energy
  - matter
  - light

ANS: D PTS: 1

TOP: 2-4 What Are Systems and How Do They Respond to Change?

KEY: Bloom's: Remember NOT: Modified

46. One property of a system is that it \_\_\_\_.
- functions in a regular and predictable manner
  - is highly randomized in its processes
  - cannot be accurately modeled
  - consists solely of inputs and outputs
  - exists only in models

ANS: A PTS: 1

TOP: 2-4 What Are Systems and How Do They Respond to Change?

KEY: Bloom's: Understand NOT: Modified

47. Feedback causes \_\_\_\_ in a system.
- change
  - equilibrium
  - chaos
  - error
  - noise

ANS: A PTS: 1

TOP: 2-4 What Are Systems and How Do They Respond to Change?

KEY: Bloom's: Remember NOT: New

48. Which of the following illustrates a negative feedback loop?
- melting polar ice
  - exponential population growth
  - a thermostat maintaining a certain temperature in your house
  - the greenhouse effect
  - vegetation removed from a stream valley

ANS: C PTS: 1

TOP: 2-4 What Are Systems and How Do They Respond to Change?

KEY: Bloom's: Apply NOT: Modified

49. What is the point of a fundamental shift in the behavior of a system?
- negative feedback
  - positive feedback
  - tipping point
  - time delay
  - synergistic point

ANS: C PTS: 1

TOP: 2-4 What Are Systems and How Do They Respond to Change?

KEY: Bloom's: Understand NOT: New

50. What term describes the lack of system response system during a period of time?
- threshold level
  - time delay
  - tipping point
  - negative feedback
  - positive feedback

ANS: B                      PTS: 1

TOP: 2-4 What Are Systems and How Do They Respond to Change?

KEY: Bloom's: Remember                      NOT: New

### TRUE/FALSE

51. Scientists tend to be highly skeptical of new data, hypotheses, and models until they can be tested and verified.

ANS: T                      PTS: 1                      TOP: 2-1 What Do Scientists Do?

KEY: Bloom's: Remember

52. When someone says that evolution is not important, "after all, it's just a theory," it is probable that they do not understand how scientists use the term "theory."

ANS: T                      PTS: 1                      TOP: 2-1 What Do Scientists Do?

KEY: Bloom's: Understand

53. Tentative or frontier science is performed by amateur scientists whose work will never be accepted by their peers.

ANS: F                      PTS: 1                      TOP: 2-1 What Do Scientists Do?

KEY: Bloom's: Remember

54. Scientists can disprove things but they cannot prove anything absolutely, which means there is always some uncertainty in science.

ANS: T                      PTS: 1                      TOP: 2-1 What Do Scientists Do?

KEY: Bloom's: Understand

55. Atoms have a net positive electrical charge.

ANS: F                      PTS: 1

TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?

KEY: Bloom's: Remember

56. A chemical formula is a shorthand way of writing the symbols for atoms or ions in a compound.

ANS: T                      PTS: 1

TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?

KEY: Bloom's: Remember

57. Methane, a hydrocarbon, is considered an organic molecule even though it contains only one carbon atom.

ANS: T                   PTS: 1  
TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?  
KEY: Bloom's: Understand

58. How useful matter is to humans as a resource is determined by its concentration, availability for use, and its potential.

ANS: T                   PTS: 1  
TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?  
KEY: Bloom's: Remember

59. In a nuclear fission reaction, atoms are destroyed.

ANS: F                   PTS: 1  
TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?  
KEY: Bloom's: Remember

60. According to the law of conservation of matter, once trash decomposes in a landfill, we have completely gotten rid of the matter that made up the trash.

ANS: F                   PTS: 1  
TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?  
KEY: Bloom's: Understand

61. Energy cannot be recycled.

ANS: T                   PTS: 1  
TOP: 2-3 What Is Energy and What Happens When It Undergoes Change?  
KEY: Bloom's: Remember

62. Burning coal demonstrates the conversion of energy from kinetic to potential.

ANS: F                   PTS: 1  
TOP: 2-3 What Is Energy and What Happens When It Undergoes Change?  
KEY: Bloom's: Understand

63. Energy consumption does not mean the disappearance of energy; rather, it is the conversion of energy from one form to another with no net loss.

ANS: T                   PTS: 1  
TOP: 2-3 What Is Energy and What Happens When It Undergoes Change?  
KEY: Bloom's: Remember

64. The scientific principles of sustainability show that everything we do affects someone or something in the environment in some way.

ANS: T                   PTS: 1  
TOP: 2-4 What Are Systems and How Do They Respond to Change?  
KEY: Bloom's: Understand

65. A negative feedback loop causes a system to further change in the same direction.

ANS: F                   PTS: 1  
TOP: 2-4 What Are Systems and How Do They Respond to Change?

KEY: Bloom's: Understand

## COMPLETION

66. Science is based on the assumption that events in the natural world follow \_\_\_\_\_ patterns that can be understood.

ANS:  
cause-and-effect  
cause and effect

PTS: 1 TOP: 2-1 What Do Scientists Do? KEY: Bloom's: Remember

67. \_\_\_\_\_ happens when scientists report details of their research and other scientists evaluate it.

ANS: Peer review

PTS: 1 TOP: 2-1 What Do Scientists Do? KEY: Bloom's: Remember

68. A molecule is a combination of two or more atoms held together by forces called \_\_\_\_\_.

ANS:  
chemical bonds  
bonds

PTS: 1 TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?  
KEY: Bloom's: Remember

69. Compounds are combinations of two or more different elements held together in \_\_\_\_\_ proportions.

ANS: fixed

PTS: 1 TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?  
KEY: Bloom's: Remember

70. A(n) \_\_\_\_\_ has more hydrogen ions than hydroxide ions and has a pH \_\_\_\_\_ 7.

ANS: acidic solution; less than

PTS: 1 TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?  
KEY: Bloom's: Remember

71. An organic compound is one that contains one or more \_\_\_\_\_ atoms combined with atoms of one or more other elements.

ANS: carbon

PTS: 1 TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?  
KEY: Bloom's: Remember

72. If a macromolecule was a brick wall it would be called a(n) \_\_\_\_\_ made up of repeating units called \_\_\_\_\_.

ANS: polymer; monomers

PTS: 1 TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?  
KEY: Bloom's: Remember

73. Thousands of genes make up a single \_\_\_\_\_, a double helix DNA molecule wrapped around proteins.

ANS: chromosome

PTS: 1 TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?  
KEY: Bloom's: Remember

74. According to the \_\_\_\_\_, when a physical or chemical change occurs, no atoms are created or destroyed.

ANS: law of conservation of matter

PTS: 1 TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?  
KEY: Bloom's: Remember

75. Body fat of a human or other animal is a type of \_\_\_\_\_ energy.

ANS: potential

PTS: 1 TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?  
KEY: Bloom's: Remember

76. Most of the energy from burning a gallon of gasoline is lost as \_\_\_\_\_ energy called heat.

ANS:  
low-quality  
low quality

PTS: 1 TOP: 2-3 What Is Energy and What Happens When It Undergoes Change?  
KEY: Bloom's: Remember

77. A(n) \_\_\_\_\_ occurs when an output of matter, energy, or information is fed back into the system as an input and leads to changes in the system.

ANS: feedback loop

PTS: 1 TOP: 2-3 What Is Energy and What Happens When It Undergoes Change?  
KEY: Bloom's: Remember

78. There are many types of electromagnetic radiation, each with a different \_\_\_\_\_ and energy content.

ANS: wavelength

PTS: 1 TOP: 2-3 What Is Energy and What Happens When It Undergoes Change?  
KEY: Remember

79. A(n) \_\_\_\_\_ is a set of components that function and interact in some regular way.

ANS: system

PTS: 1 TOP: 2-4 What Are Systems and How Do They Respond to Change?  
KEY: Bloom's: Remember

80. Any process that increases or decreases a change to a system is called a(n) \_\_\_\_\_.

ANS:  
feedback  
feedback loop

PTS: 1 TOP: 2-4 What Are Systems and How Do They Respond to Change?  
KEY: Bloom's: Remember

### SHORT ANSWER

81. Briefly describe the scientific process outlined in this chapter.

ANS:  
Identify a problem, find out what is known about the problem, ask a question to investigate, perform an experiment to collect data, propose a hypothesis to explain the data, use the hypothesis to make projections that can be tested, test projections with further experiments, accept or revise hypothesis.

PTS: 1 TOP: 2-1 What Do Scientists Do? KEY: Bloom's: Remember  
NOT: New

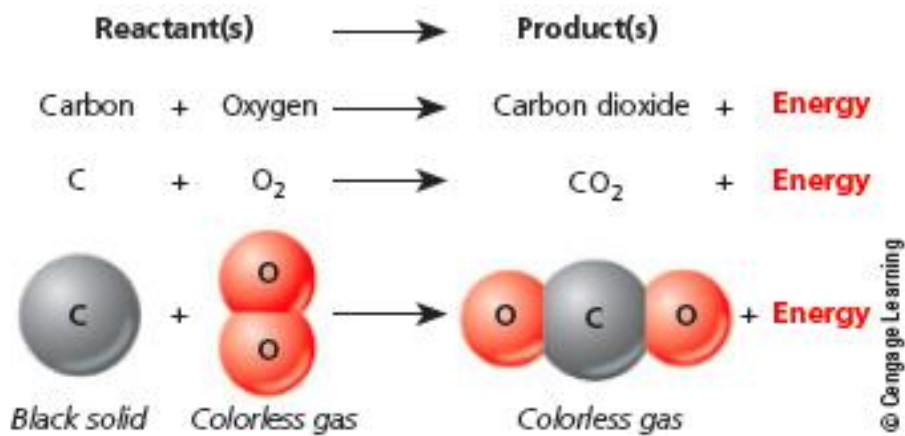
82. Explain how a scientific law comes to be accepted.

ANS:  
A scientific law comes after a hypothesis is very well tested by several different scientists. The law is well-tested and widely accepted by the scientific community.

PTS: 1 TOP: 2-1 What Do Scientists Do? KEY: Bloom's: Understand  
NOT: New

83. Draw the basic chemical reaction of carbon and oxygen ( $C + O_2$ )

ANS:



PTS: 1                    TOP: 2-2 What Is Matter and What Happens When It Undergoes Change?  
 KEY: Bloom's: Remember                    NOT: New

84. Explain how heat is a form of kinetic energy.

ANS:

Heat is a form of kinetic energy because it is the total kinetic energy of all moving atoms, ions, and molecules in an object. The atoms, ions, and molecules are all vibrating, and kinetic energy is the energy of movement.

PTS: 1                    TOP: 2-3 What Is Energy and What Happens When It Undergoes Change?  
 KEY: Bloom's: Understand                    NOT: New

85. Give an example of a positive feedback loop and explain the process.

ANS:

Answers may vary.

Melting glaciers are positive feedback loops. As ice melts, there is less light-colored ice to reflect sunlight, so more is absorbed, which warms the air and causes more melt.

PTS: 1                    TOP: 2-4 What Are Systems and How Do They Respond to Change?  
 KEY: Bloom's: Apply                    NOT: New

## ESSAY

86. Explain how the human body is intimately connected to the two laws of thermodynamics.

ANS:

(pages 46-47) The first law of thermodynamics says that energy can neither be created nor destroyed, only transformed. This is the basis of the flow of energy from the sun through living systems on earth, including humans. We take in energy in the form of chemicals assembled by other living organisms and transform it, using the energy to do the many things required to live. If any living organism fails to take in and transform energy for their purposes, the second law of thermodynamics takes over. The second law says entropy (randomness or disorder) tends to increase in energy systems. In shortened form, the second law means we will die and decompose. Energy is required to keep a system functioning. When the system is no longer taking in energy, randomness or disorder will increase.

PTS: 1                    OBJ: Critical Thinking



TOP: 2-3 What Is Energy and What Happens When It Undergoes Change?

KEY: Bloom's: Understand

NOT: Modified

87. Differentiate between a hypothesis, a guess, and a theory. Explain why it is important for non-scientists to understand how scientists use these terms when discussing something like global warming or evolution. Why might it be incorrect when a non-scientist dismisses a topic like these as being "just a theory"?

ANS:

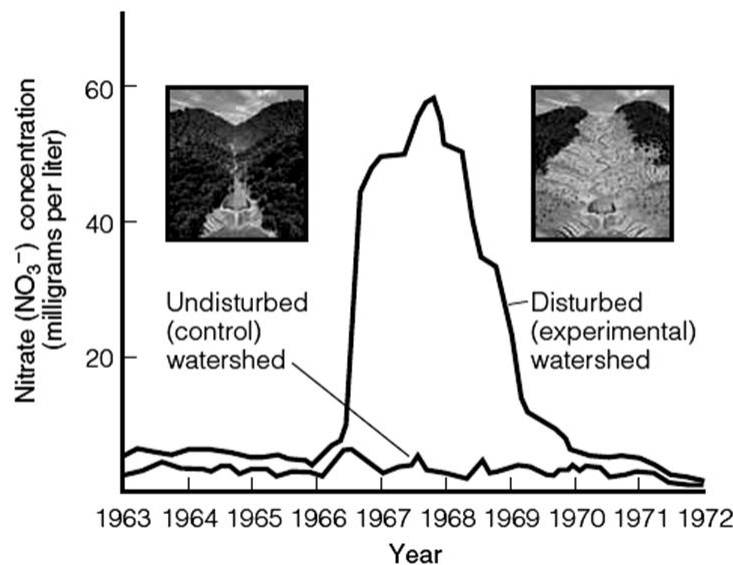
A hypothesis is an effort to explain phenomenon based on prior experience with the same or similar phenomena. It is often defined as an educated guess. The usual way to define a "guess" is the suggestion of an answer without prior experience. A theory is a structure intended to explain a series of phenomena, and is constructed from hypotheses that have been tested and not proven wrong. As such, a theory is based on substantial amounts of data.

PTS: 1

OBJ: Critical Thinking

TOP: 2-1 What Do Scientists Do?

KEY: Bloom's: Understand



88. With reference to the accompanying figure, explain the significant difference that occurred between 1966 and 1970 in terms of the two lines representing the control watershed and the experimental watershed.

ANS:

The line labeled "Disturbed (experimental) watershed" represents the level of loss of nitrates following the removal of vegetation in the experimental watershed. Without vegetation the soil rapidly lost the nitrates to rainfall until they were substantially gone.

PTS: 1

OBJ: Critical Thinking

TOP: Figure 2-5 | 2-2 What Is Matter and What Happens When It Undergoes Change?

KEY: Bloom's: Analyze

89. Much of the energy produced is lost before it can become useful. Explain how energy efficiency, or energy productivity, and the second law of thermodynamics may be useful in a discussion with another person on how to reduce CO<sub>2</sub> and other greenhouse gas emissions.

ANS:

Machines that use fossil fuels are very energy-inefficient, converting a small percentage of the energy in the fuel source to useful activities. An effort to increase the level of efficiency would substantially reduce the amount of fossil fuel that needed to be converted and would reduce the amount of emissions of CO<sub>2</sub> and other greenhouse gases.

PTS: 1                    OBJ: Critical Thinking  
TOP: 2-3 What Is Energy and What Happens When It Undergoes Change?  
KEY: Bloom's: Understand

90. How is the concept of an environmental threshold or tipping point important in regards to global warming?

ANS:

A tipping point is a level at which a critical mass has been reached that causes an event to occur, an event that may be irreversible. If humans cause the climate of the earth to warm beyond a certain level, it may be impossible to correct the situation, and the climate may be irreversibly altered for the worse.

PTS: 1                    OBJ: Critical Thinking  
TOP: 2-4 What Are Systems and How Do They Respond to Change?  
KEY: Bloom's: Understand