Chapter 02 – Science, Matter, Energy, and Systems

True/False

1. Because scientific theories are tentative explanations, they should not be taken seriously.
   a. True
   b. False

ANSWER: False
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.1 What Do Scientists Do?
QUESTION TYPE: True/False
LEARNING OBJECTIVES: .

2. Scientists use data to develop testable hypotheses, which are often written as "If… then" statements.
   a. True
   b. False

ANSWER: True
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.1 What Do Scientists Do?
QUESTION TYPE: True/False
LEARNING OBJECTIVES: .

3. When a natural system gets locked into a positive feedback loop, it can reach an ecological tipping point.
   a. True
   b. False

ANSWER: True
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.4 What Are Systems and How Do They Respond to Change?
QUESTION TYPE: True/False
LEARNING OBJECTIVES: .

4. Carbon is an element, meaning that it cannot be broken down further by chemical means.
   a. True
   b. False

ANSWER: True
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: True/False

LEARNING OBJECTIVES: .

5. Logic and critical thinking are more important tools in science than imagination and creativity.
   a. True
   b. False

ANSWER: False
DIFFICULTY: Bloom's: Understand
REFERENCES: 2.1 What Do Scientists Do?
QUESTION TYPE: True/False
LEARNING OBJECTIVES: .

6. When matter undergoes physical changes, the chemical composition also changes.
   a. True
   b. False

ANSWER: False
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: True/False
LEARNING OBJECTIVES:

7. Hydrocarbons are organic compounds.
   a. True
   b. False

ANSWER: True
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: True/False
LEARNING OBJECTIVES: .

8. The process of peer review is important to help reduce bias and related problems.
   a. True
   b. False

ANSWER: True
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.1 What Do Scientists Do?
QUESTION TYPE: True/False

LEARNING OBJECTIVES:

9. A positive feedback loop causes a system to change in the opposite direction from which it is moving.
   a. True
   b. False

ANSWER: False
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.4 What Are Systems and How Do They Respond To Change?
QUESTION TYPE: True/False
LEARNING OBJECTIVES:

10. Pure water has a pH of 7, exactly neutral.
   a. True
   b. False

ANSWER: True
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.3 What Is Energy and What Happens When It Undergoes Change?
QUESTION TYPE: True/False
LEARNING OBJECTIVES:

11. The idea that all elements are made up of molecules is called the atomic theory.
   a. True
   b. False

ANSWER: False
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: True/False
LEARNING OBJECTIVES:

12. Two or more different elements can combine to form isotopes.
   a. True
   b. False

ANSWER: False
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: True/False

LEARNING OBJECTIVES:

13. Each cell of the human body has different chromosomes in its nucleus.
    a. True
    b. False

ANSWER: False
DIFFICULTY: Bloom's: Understand
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: True/False
LEARNING OBJECTIVES:

14. A chart showing all known elements arranged by their chemical behavior is called the periodic table.
    a. True
    b. False

ANSWER: True
DIFFICULTY: Bloom's: Understand
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: True/False
LEARNING OBJECTIVES:

15. A scientific hypothesis must be testable.
    a. True
    b. False

ANSWER: True
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.1 What Do Scientists Do?
QUESTION TYPE: True/False
LEARNING OBJECTIVES:

Multiple Choice

16. Recall the Bormann-Likens controlled experiment in the forested valleys of New Hampshire. Which statement best describes the effects of water flowing out of deforested areas into undisturbed areas?
    a. The amount of water flowing out of the deforested valley following rain increased by 30–40%, and soil erosion increased.
    b. The amount of water flowing out of the deforested valley decreased by 10–20%, and soil erosion decreased.

c. The flow of water did not change, but soil erosion increased.
d. Other types of plants took the place of the trees, preventing deforestation from affecting the flow of water.
e. Eroding soil dammed up the river, preventing the flow of water.

ANSWER: a
DIFFICULTY: Bloom's: Understand
REFERENCES: Core Case Study: How Do Scientists Learn about Nature? Experimenting with a Forest
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

17. The Bormann–Likens study in the Hubbard Brook Experimental Forest in New Hampshire can be described as ____.
a. a comparison of a control site with an experimental site in nature
b. a study using computer model simulations of a complex natural system
c. an experiment in which too many factors were varied to draw a conclusion from the results
d. missing a baseline for comparison, making it difficult to draw a conclusion from the results
e. an observational study that attempted not to interfere with a natural system

ANSWER: a
DIFFICULTY: Bloom's: Understand
REFERENCES: Core Case Study: How Do Scientists Learn about Nature? Experimenting with a Forest
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

18. Which of the following is the best definition of science?
a. A field in which observations are rarely tested
b. A field that is never investigated using statistical tools and models
c. Study that is best described as a collection of opinions
d. Data supported by small amounts of evidence
e. A broad field of study focused on discovering how nature works

ANSWER: e
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.1 What Do Scientists Do?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES: .

19. A(n) ____ is an approximate representation or simulation of a system.
    a. model
    b. datum
    c. projection
    d. experiment
    e. study

ANSWER: a
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.1 What Do Scientists Do?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

20. Scientific hypotheses differ from scientific theories in that they are ____.
    a. widely accepted descriptions of what we find happening over and over in nature
    b. possible, but not yet well-tested, explanations of data
    c. not able to be tested
    d. arrived at after extensive mathematical modeling
    e. facts rather than opinions

ANSWER: b
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.1 What Do Scientists Do?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES: .

21. A classmate tells you that a statement heard on the news about an environmental process noted in a local ecosystem cannot be true because it has not been scientifically proven. Given what you know about the nature of scientific reasoning, you realize that ____.
    a. this classmate is misinformed because science cannot prove anything, but it can disprove events conclusively
    b. this classmate is misinformed because science cannot prove or disprove anything absolutely
    c. this classmate is misinformed because the environmental process in question actually has been proven scientifically
    d. this classmate is correct
    e. this classmate has confused scientific theories and scientific laws

ANSWER: b
DIFFICULTY: Bloom's: Understand
REFERENCES: 2.1 What Do Scientists Do?

QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

22. Which list describes the sequence scientists typically follow in the beginning stages of their investigations about how nature works?

a. analyze data → search literature → perform experiment → identify a problem → ask a question
b. ask a question → search literature → perform experiment → analyze data → identify a problem
c. search literature → ask a question → identify a problem → analyze data → perform experiment
d. identify a problem → search literature → ask a question → perform experiment → analyze data
e. ask a question → search literature → identify a problem → perform experiment → analyze data

ANSWER: d
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.1 What Do Scientists Do?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

23. What is one reason that statistics and mathematical models are so important in science?

a. Scientific data is often biased.
b. Scientific data is often incorrect due to poor experimental design and limitations on data collection, so mathematics can be used to smooth over these inaccuracies.
c. The process of peer review is flawed and insufficient.
d. These help to deal with complex interactions of variables and there is no way to measure every instance of a phenomenon.
e. It allows scientists to prove their results conclusively.

ANSWER: D
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.1 What Do Scientists Do?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES: .

Narrative: (questions 9 and 10)
A tiny, tawny colored butterfly called the Carson Wandering Skipper was always known for its small and very localized populations. Typically, it was found along the western Nevada and eastern California high desert areas. It was always located close to hot springs and other wet areas that supported saltgrass, the host plant it depended on.

Recently, the populations went into a steep decline, and a last hold-out area was threatened by imminent construction of a freeway bypass. Biologists became alarmed and began an intensive search for populations in locations other than the spot designated for the freeway bypass. They began their search by identifying all

known locations of hot springs, in hopes of finding small populations of the Carson Wandering Skipper close by.

24. The biologists' observations that the Carson Wandering Skipper populations had declined is an example of ____.

a. reporting a conclusion
b. identifying a problem
c. performing an experiment
d. proposing a hypothesis
e. making testable predictions

ANSWER: b
DIFFICULTY: Bloom's: Understand
REFERENCES: 2.1 What Do Scientists Do?
QUESTION TYPE: Multiple Choice
PREFACE NAME: Narrative
LEARNING OBJECTIVES:

25. As biologists searched for previously unknown populations of the Carson Wandering Skipper, biologists wondered if hot springs were absolutely essential to its survival. This phase of the investigation is ____.

a. finding out what is known and asking a question
b. analyzing data and asking a question
c. asking a question and testing predictions
d. accepting their hypothesis and analyzing data
e. accepting their hypothesis and asking a question

ANSWER: a
DIFFICULTY: Bloom's: Understand
REFERENCES: 2.1 What Do Scientists Do?
QUESTION TYPE: Multiple Choice
PREFACE NAME: Narrative
LEARNING OBJECTIVES:

26. Science that is based on thorough testing with appropriate statistics and that has withstood peer review is considered ____.

a. limited but accurate
b. scientific laws
c. scientific theories
d. unreliable science
e. reliable science

ANSWER: e
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.1 What Do Scientists Do?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

27. The finding that objects fall to earth at predictable speeds is described by ____.
    a. the law of conservation of energy
    b. the law of kinetic energy
    c. the law of potential energy
    d. the law of energy transformations
    e. the law of gravity

ANSWER: e
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.1 What Do Scientists Do?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

28. A scientific law ____.
    a. is a hypothesis that has been proven
    b. is what a theory becomes when it passes experimental tests
    c. is called that because there are consequences when it is broken
    d. is a well-tested and widely accepted description of what we find happening repeatedly and in the same way in nature
    e. determines the series of steps that should be followed when designing an experiment to test a hypothesis

ANSWER: d
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.1 What Do Scientists Do?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

29. Matter is best described as ____.
    a. thermodynamic
    b. something that has the capacity to do work
    c. positively charged
    d. something that can produce change

e. anything that has mass and takes up space

ANSWER: e
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter And What Happens When It Undergoes Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

30. Which of the following is true of matter?
a. It can exist as three physical states.
b. It can exist as two physical states.
c. It can exist as three chemical forms.
d. It can exist as four chemical forms.
e. It can exist as a physical state or as a chemical form.

ANSWER: a
DIFFICULTY: Bloom's: Understand
REFERENCES: 2.2 What Is Matter And What Happens When It Undergoes Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

31. The atomic number of an element is the number of ____.
a. atoms in a molecule
b. protons in an atom
c. nuclei in a molecule
d. electrons in an atom
e. protons and neutrons in an atom

ANSWER: b
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter And What Happens When It Undergoes Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

32. Protons, neutrons, and electrons are all ____.
a. forms of energy
b. equal in mass
c. subatomic particles
d. negative ions

e. charged particles

ANSWER: c
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

33. An atom's mass number is equal to the total number of ____.
a. neutrons and isotopes
b. neutrons and electrons
c. neutrons and protons
d. protons, neutrons, and electrons
e. protons only

ANSWER: c
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

34. An element ____.
a. can combine with protons to make an atom
b. is made up of compounds
c. can combine with one or more other elements to make a compound
d. is defined by the number of electrons it has
e. can only be organic

ANSWER: c
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

35. You are studying atoms in the lab and realize that you have two atoms with the same atomic number but different numbers of neutrons. These atoms must be ____.
a. molecules
b. compounds
c. ions

d. isotopes
e. organic

ANSWER: d
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

36. Ions are atoms or groups of atoms that have ____.
a. gained or lost electrons
b. gained or lost protons
c. gained or lost neutrons
d. gained or lost both protons and electrons
e. different numbers of both protons and neutrons from other atoms of that type

ANSWER: a
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

37. Which of the following lists of items contains only ions?
a. CO_2, H_2O, Na^+, H^-
b. Na^+, H^-, Pb, Hg
c. Pb, Hg, CO_2, NaCl
d. Cl^-, Na^+, Ca^{2+}, NO_3^-
e. NaCl, NO, CO, NaOH

ANSWER: d
DIFFICULTY: Bloom's: Understand
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

38. An acidic solution would have ____.
a. more hydroxide ions than hydrogen ions and a pH greater than 7
b. more hydrogen ions than hydroxide ions and a pH greater than 7

c. more hydroxide ions than hydrogen ions and a pH less than 7
d. more hydroxide ions than hydrogen ions and a pH of 7
e. more hydrogen ions than hydroxide ions and a pH less than 7

ANSWER: e
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

39. All organic compounds are primarily characterized by the presence of ____.
a. carbon
b. hydrogen
c. oxygen
d. nitrogen
e. phosphorus

ANSWER: a
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

40. Why do we have pairs of each chromosome type in the cell nucleus?
a. One is a spare in case the other is damaged.
b. One is always redundant.
c. One is inherited from each parent.
d. One contains DNA molecules and one contains genes.
e. One contains nucleotides and the other does not.

ANSWER: c
DIFFICULTY: Bloom's: Understand
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

41. The nucleus of a human cell contains ____.
a. genes only
b. DNA molecules only

c. chromosomes only
d. genes on chromosomes, which are made up of DNA molecules
e. chromosomes on genes

ANSWER: d
DIFFICULTY: Bloom's: Understand
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

42. ____ are the fundamental structural and functional units of life.
a. Ions
b. Atoms
c. Compounds
d. Molecules
e. Cells

ANSWER: e
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

43. Which term means the molecule produced when simple organic molecules called monomers are linked together by chemical bonds?
a. Chromosomes
b. Lipids
c. Polymers
d. Hydrocarbons
e. Elements

ANSWER: c
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

44. Genes are composed of sequences of ____.
    a. ions
    b. chromosomes
    c. cells
    d. nucleotides
    e. proteins

ANSWER: d
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

45. The law of conservation of matter states that whenever matter undergoes a physical or chemical change, ____.
    a. atoms can be created
    b. atoms can be destroyed
    c. atoms cannot be created or destroyed
    d. atoms can be destroyed if we compost them
    e. atoms can be created by reactions between organic compounds

ANSWER: c
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

46. A reaction in which a carbon atom combines with oxygen atoms to form CO_2 is ____.
    a. a physical change
    b. a chemical change
    c. both a physical and chemical change
    d. first a physical change, but then it becomes a chemical change
    e. neither a physical change or a chemical change, but a scientific change

ANSWER: b
DIFFICULTY: Bloom's: Understand
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: Multiple Choice

LEARNING OBJECTIVES:

47. Energy can be formally defined as the ____.
    a. velocity of any moving object
    b. heat generated by atoms losing electrons
    c. capacity to do work
    d. displacement of heat from the sun to the earth
    e. process of moving objects

ANSWER: c
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.3 What Is Energy and What Happens When It Undergoes Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

48. What happens when you place a cold pot on a hot stovetop?
    a. Energy flows from the air to the stovetop.
    b. There is no net movement of energy.
    c. Energy flows evenly back and forth between the pot and the stovetop.
    d. Energy flows from the base of the pot to the stovetop.
    e. Energy flows from the stovetop to the base of the pot.

ANSWER: e
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.3 What Is Energy and What Happens When It Undergoes Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

49. An example of kinetic energy is _____.
    a. water in a reservoir behind a dam
    b. water flowing down a waterfall
    c. a rock held in your hand several feet above ground
    d. the chemical energy in gasoline
    e. the chemical energy in food

ANSWER: b
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.3 What Is Energy and What Happens When It Undergoes Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

50. Kinetic energy and potential energy differ in that____.
    a. heat is a type of potential energy, not kinetic energy
    b. kinetic energy is energy of motion and potential energy is stored energy
    c. potential energy is energy of motion and kinetic energy is commercial energy
    d. only potential energy involves movement
    e. only kinetic energy involves energy storage

ANSWER: b
DIFFICULTY: Bloom's: Understand
REFERENCES: 2.3 What Is Energy and What Happens When It Undergoes Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

51. The first law of thermodynamics is also known as____.
    a. the law of energy quality
    b. the law of conservation of energy
    c. the law of potential energy
    d. the law of kinetic energy
    e. the law of energy consumption

ANSWER: b
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.3 What Is Energy and What Happens When It Undergoes Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

52. Energy that is greatly dispersed and low temperature is considered____.
    a. medium-quality energy
    b. high-quality energy
    c. low-quality energy
    d. medium or high-quality energy depending on whether it is from wind or burning
    e. kinetic or potential energy depending upon its quality

ANSWER: c
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.3 What Is Energy and What Happens When It Undergoes Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

53. The second law of thermodynamics says that whenever energy is converted from one form to another in a physical or chemical change, ____.

a. more energy will be present in the second form
b. heat is absorbed
c. light is produced
d. we end up with lower-quality or less useable energy than we started with
e. the second form of energy will always be kinetic

ANSWER: d
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.3 What Is Energy and What Happens When It Undergoes Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

54. ____ is a measure of the amount of energy available to do useful work.

a. Energy quality
b. Energy effectiveness
c. Energy conservation
d. Energy efficiency
e. Energy radiation

ANSWER: a
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.3 What Is Energy and What Happens When It Undergoes Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES: -.

55. Which of the following energy forms is low quality?

a. The energy released by burning coal
b. The heat dispersed in the ocean
c. Concentrated sunlight
d. High-speed wind
e. The energy released by burning wood

ANSWER: b
DIFFICULTY: Bloom's: Understand
REFERENCES: 2.3 What Is Energy and What Happens When It Undergoes Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES: -.

56. A positive feedback loop ____.
    a. increases a change to a system
    b. always results in a beneficial change to a system
    c. decreases a change to a system
    d. never results in a beneficial change to a system
    e. stabilizes a system

ANSWER: a
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.4 What Are Systems and How Do They Respond To Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES: -

57. A thermostat set to 62°F turns on the furnace when a house cools below that temperature, and shuts the furnace off when a house warms above that temperature. This is an example of a simple ____.
    a. positive feedback loop
    b. negative feedback loop
    c. system loop
    d. tipping point
    e. thermodynamic loop

ANSWER: b
DIFFICULTY: Bloom's: Understand
REFERENCES: 2.4 What Are Systems and How Do They Respond To Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES: --.

58. A form of kinetic energy that travels in the form of a wave as a result of changes in electrical and magnetic fields is ____.
    a. wind
    b. electromagnetic radiation
    c. waterfalls
    d. chemical energy
    e. heat energy

ANSWER: b
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.3 What Is Energy and What Happens When It Undergoes Change?

QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

59. Which form of electromagnetic radiation has the shortest wavelength?
    a. Infrared radiation
    b. Radio waves
    c. Visible light
    d. Ultraviolet (UV) radiation
    e. Microwaves

ANSWER: d
DIFFICULTY: Bloom's: Understand
REFERENCES: 2.3 What Is Energy and What Happens When It Undergoes Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

60. Most living systems can be described as having inputs, ____, and outputs.
    a. Thermodynamics
    b. Positive transfers
    c. Throughputs
    d. Kinetics
    e. Creations

ANSWER: c
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.4 What Are Systems and How Do They Respond To Change?
QUESTION TYPE: Multiple Choice
LEARNING OBJECTIVES:

Matching

Match items with their appropriate chemical description.
a. chemical formula
b. molecule
c. electron
d. proton

e. neutron
f. pH
g. O_2
h. monomers
i. mass number
j. polymers
k. $C_6H_{12}O_6$

DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: Matching
LEARNING OBJECTIVES:

61. The chemical symbol for oxygen gas
ANSWER: g

62. A subatomic particle with no net electrical charge
ANSWER: e

63. A large molecule made up of repeating subunits.
ANSWER: j

64. Simple molecules that can be joined together to form large molecules.
ANSWER: h

65. The total number of protons and neutrons in an atom's nucleus
ANSWER: i

66. A subatomic particle with a positive charge
ANSWER: d

67. A way to describe the number of each type of atom or ion in a compound
ANSWER: a

68. The scale used to measure acidity
ANSWER: f

69. The chemical formula for glucose

ANSWER: k

70. A subatomic particle with a negative charge
ANSWER: c

71. Two or more atoms held together by chemical bonds
ANSWER: b

Completion

72. Well-designed scientific experiments compare something between two groups, an experimental group and a _____group. These groups are as similar as possible except for the variable of interest.
ANSWER: control
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.1 What Do Scientists Do?
QUESTION TYPE: Completion
LEARNING OBJECTIVES:

73. A well-tested and widely accepted scientific hypothesis or a group of related hypotheses is called a(n) _____.
ANSWER: scientific theory
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.1 What Do Scientists Do?
QUESTION TYPE: Completion
LEARNING OBJECTIVES:

74. The statement that, "If land is cleared of vegetation and exposed to rain and melting snow, then the land retains less water and loses soil nutrients," is an example of a(n) _____.
ANSWER: hypothesis
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.1 What Do Scientists Do?
QUESTION TYPE: Completion
LEARNING OBJECTIVES:

75. DNA molecules are coiled and shaped around proteins to form larger structures called _____.
ANSWER: chromosomes
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: Completion

LEARNING OBJECTIVES:

76. A(n) _____ is a type of matter that has a unique set of properties and that cannot be broken down into simpler substances by chemical means.

ANSWER: element
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: Completion
LEARNING OBJECTIVES:

77. A chemical that is a combination of two or more different elements in fixed proportions is called a(n) _____.

ANSWER: compound
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: Completion
LEARNING OBJECTIVES:

78. Ions are formed when an atom or group of atoms gains or losses _____.

ANSWER: electrons
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: Completion
LEARNING OBJECTIVES:

79. The pH of a solution is a measure of _____ ions and _____ ions in that solution.

ANSWER: hydrogen;
hydroxide
hydroxide;
hydrogen

DIFFICULTY: Moderate
QUESTION TYPE: Completion

80. One essential nutrient for plant growth studied by Bormann and Likens is _____.

ANSWER: nitrate
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?

QUESTION TYPE: Completion
LEARNING OBJECTIVES:

81. A simple carbohydrate that plants and animals use to obtain energy is _____.
ANSWER: glucose
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: Completion
LEARNING OBJECTIVES:

82. A molecule consists of two or more atoms connected by _____.
ANSWER: chemical bonds
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: Completion
LEARNING OBJECTIVES:

83. The only organic molecule with fewer than two carbon atoms is _____.
ANSWER: methane
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: Completion
LEARNING OBJECTIVES:

84. Flowing water is an example of _____ energy.
ANSWER: kinetic
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.3 What Is Energy and What Happens When It Undergoes Change?
QUESTION TYPE: Completion
LEARNING OBJECTIVES:

85. Organic compounds always contain _____ atoms.
ANSWER: carbon
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.3 What Is Energy and What Happens When It Undergoes Change?
QUESTION TYPE: Completion
LEARNING OBJECTIVES:

86. Within some DNA molecules are certain sequences of nucleotides called
ANSWER: genes
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: Completion
LEARNING OBJECTIVES:

87. Macromolecules formed from a number of monomers are called _____.
ANSWER: polymers
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: Completion
LEARNING OBJECTIVES:

88. The law of _____ of matter states that whenever matter undergoes a physical or chemical change, no atoms are created or destroyed.
ANSWER: conservation
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: Completion
LEARNING OBJECTIVES:

89. A(n) _____ is a set of components that function and interact in some regular way.
ANSWER: system
DIFFICULTY: Bloom's: Remember
REFERENCES: 2.4 What Are Systems and How Do They Respond To Change?
QUESTION TYPE: Completion
LEARNING OBJECTIVES:

Subjective Short Answer

90. Give an example of a way you can convert potential energy into kinetic energy.
ANSWER: *Sample answers:*
- Eat food to keep body working.
- Drop an object.
- Burn wood for heat.

DIFFICULTY: Bloom's: Apply
REFERENCES: 2.3 What Is Energy and What Happens When It Undergoes Change?
QUESTION TYPE: Subjective Short Answer

LEARNING OBJECTIVES:

91. A scientific hypothesis must be testable. What does this mean?

ANSWER: It must be possible to use the hypothesis to generate predictions about what will happen if the hypothesis is true and that can be tested using a scientific experiment.
DIFFICULTY: Bloom's: Understand
REFERENCES: 2.1 What Do Scientists Do?
QUESTION TYPE: Subjective Short Answer
LEARNING OBJECTIVES:

92. Give an example of a positive feedback loop.

ANSWER: Examples could include:
Hubbard Brook experiments, where removing vegetation from a stream valley caused soil erosion and losses of nutrients, which caused more vegetation to die.
A stock market crash, in which falling stock values cause investors to sell, which lowers values further.
DIFFICULTY: Bloom's: Apply
REFERENCES: 2.4 What Are Systems and How Do They Respond To Change?
QUESTION TYPE: Subjective Short Answer
LEARNING OBJECTIVES:

93. What are the physical states and chemical forms of matter?

ANSWER: Matter has three physical states: solid, liquid and gas. It has two chemical forms: elements and compounds.
DIFFICULTY: Bloom's: Understand
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: Subjective Short Answer
LEARNING OBJECTIVES:

Essay

94. The Bormann-Likens scientific investigation of clear-cutting forest watersheds is an example of reliable science. What does that tell you about the work?

ANSWER: It has been subjected to peer review, and other scientists have repeated the study and produced similar results. Reliable science consists of data, hypotheses, models, theories, and laws that are widely accepted by all or most of the scientists who are considered experts in the field under study.
DIFFICULTY: Bloom's: Apply
REFERENCES: 2.1 What Do Scientists Do?
QUESTION TYPE: Essay

LEARNING OBJECTIVES:

95. What are the three steps involved in critical thinking?

ANSWER: Be skeptical about everything you read or hear
Evaluate evidence and hypotheses using inputs and opinions from a variety of reliable sources
Identify and evaluate your personal assumptions, biases, and beliefs and distinguish between facts and opinions before coming to a conclusion.

DIFFICULTY: Bloom's: Remember
REFERENCES: 2.1 What Do Scientists Do?
QUESTION TYPE: Essay
LEARNING OBJECTIVES:

96. Describe the three major types of organic polymers important for life. Give examples of why at least two types are important.

ANSWER: The important organic polymers for life are carbohydrates, proteins, and nucleic acids. Carbohydrates are used for energy and structure. Proteins have a wide range of roles, and nucleic acids such as DNA are important repositories of information (DNA contains genes).

DIFFICULTY: Bloom's: Understand
REFERENCES: 2.2 What Is Matter and What Happens When It Undergoes Change?
QUESTION TYPE: Essay
LEARNING OBJECTIVES:

97. Why do scientists not talk about "proof" when discussing scientific research?

ANSWER: Scientists cannot prove or disprove anything absolutely because there is always some degree of uncertainty in scientific measurements, observations, and models.

DIFFICULTY: Bloom's: Understand
REFERENCES: 2.1 What Do Scientists Do?
QUESTION TYPE: Essay
LEARNING OBJECTIVES:

98. Theories are well supported by evidence and are considered key outcomes of science. However, we can't prove things conclusively in science. Is it possible to find evidence that contradicts a theory? Does your answer affect how you view theories?

ANSWER: Although theories are based on considerable evidence and are very important, scientific studies do not prove anything absolutely. As a result, it is always possible that a theory could be contradicted by future data. That should not mean that people take theories lightly as they are based on so much evidence and unlikely to be contradicted.

DIFFICULTY: Bloom's: Understand
REFERENCES: 2.1 What Do Scientists Do?

Chapter 02 – Science, Matter, Energy, and Systems

QUESTION TYPE: Essay
LEARNING OBJECTIVES:

99. Describe three limitations of science in general (as well as environmental science).

ANSWER:

1. Scientists cannot prove or disprove anything absolutely because there is always some degree of uncertainty in scientific measurements, observations and models.

2. Scientists are humans and thus are not totally free of bias about their own results and hypotheses.

3. Many systems in the natural world involve a huge number of variables with complex interactions.

DIFFICULTY: Bloom's: Understand
REFERENCES: 2.1 What Do Scientists Do?
QUESTION TYPE: Essay
LEARNING OBJECTIVES: