Chemistry Final Review

Multiple Choice
Identify the choice that best completes the statement or answers the question.

___ 1. Which field of science studies the composition and structure of matter?
   a. physics
   b. biology
   c. chemistry
   d. geology

___ 2. Which of the following would a chemist be most likely to study?
   a. a leaf floating on water
   b. a leaf changing color in autumn
   c. a leaf being blown by the wind
   d. a leaf being eaten by insects

___ 3. Which of the following best describes an example of pure chemistry?
   a. testing the effects of lower concentrations of a drug on humans
   b. studying chemicals containing carbon
   c. developing a cure for osteoporosis
   d. finding an antidote for a new strain of virus

___ 4. Which of the following statements is false?
   a. Knowledge of chemistry allows the public to make informed decisions.
   b. Studying chemistry ensures that officials make correct choices in funding technology.
   c. Knowledge of chemistry helps prepare people for careers in soil science.
   d. Chemistry explains many aspects of nature.

___ 5. Which of the following is an example of chemistry research in the main area of energy?
   a. producing bioplastics
   b. specific reactions between prescription drugs and chemicals in cells
   c. developing rechargeable batteries
   d. determining the composition of extra-terrestrial soil and rocks.

___ 6. After developing a plan, effective problem solving always involves doing what with that plan?
   a. Evaluating it.
   b. Implementing it.
   c. Analyzing it.
   d. Doing the calculation.

___ 7. A central concept of the kinetic theory, one of the “big ideas” of chemistry, is the belief that
   a. for every reaction there is an equal and opposite reaction.
   b. chemical reactions involve processes in which reactants produce products.
   c. the particles in matter are in a state of constant motion.
   d. every chemical process uses or produces energy, often in the form of heat.
8. Which of the following was a major contribution to chemistry by Antoine Lavoisier?
   a. He showed that oxygen is required for material to burn.
   b. He demonstrated the presence of phlogiston in air.
   c. He encouraged scientists to form explanations based on philosophical arguments.
   d. He developed the science of alchemy.

9. In a chemical reaction, the type of products obtained is largely determined by which part of the reacting chemicals?
   a. protons
   b. electrons
   c. neutrons
   d. nuclei

10. There are many reasons to study chemistry. In general, most people study chemistry for all of the following reasons EXCEPT?
    a. The social prestige and honor in being a chemist.
    b. Chemistry can help you satisfy your natural desire to understand how things work.
    c. Knowledge of chemistry is important for success in a variety of careers.
    d. Knowledge of chemistry is important in making informed decisions as a citizen.

11. How do conceptual problems differ from numeric problems?
    a. Solutions to conceptual problems involve analysis, while numeric solutions do not.
    b. Logic is not usually involved in solving numeric problems.
    c. A plan is necessary to solve numeric problems, but is not necessary for conceptual problems.
    d. Solutions to conceptual problems normally do not involve calculations.

12. A horizontal row of the periodic table is usually referred to as a
    a. family.
    b. period.
    c. group.
    d. property.

13. A golf ball has more mass than a tennis ball because it
    a. takes up more space.
    b. contains more matter.
    c. contains different kinds of matter.
    d. has a definite composition.

14. Which of the following is a physical property?
    a. explosive
    b. combustible
    c. melting point
    d. ability to rust

15. Which of the following is a physical property of water?
    a. It reacts with calcium metal to produce a basic solution.
    b. It can be decomposed by electrolysis.
    c. It is composed of hydrogen and oxygen.
    d. It melts below room temperature.
16. How do vapors and gases differ?
   a. Generally, a gas is in the solid state at room temperature and a vapor is in the gaseous
      state at room temperature.
   b. Generally, a gas is in the liquid state at room temperature and a vapor is in the solid state
      at room temperature.
   c. Generally, a gas is in the gaseous state at room temperature and a vapor is in either the
      solid state or liquid state at room temperature.
   d. The terms gas and vapor are always used interchangeably, there is no difference.

17. A substance that forms a vapor is generally in what physical state at room temperature?
   a. solid
   b. liquid
   c. gas
   d. liquid or solid

18. Which state of matter takes both the shape and volume of its container?
   a. solid
   b. liquid only
   c. gas only
   d. both b and c

19. Which state of matter is characterized by having an indefinite shape, but a definite volume?
   a. gas
   b. liquid only
   c. solid only
   d. both b and c

20. Which state of matter is characterized by having a definite shape and a definite volume?
    a. gas
    b. liquid only
    c. solid only
    d. both b and c

21. Which of the following is a physical property of a substance in the liquid state?
    a. definite volume
    b. indefinite mass
    c. not easily compressed
    d. definite shape

22. Which of the following is a physical change?
    a. corrosion
    b. explosion
    c. evaporation
    d. rotting of food

23. Which of the following can be classified as a mixture?
    a. pure water
    b. pure air
    c. pure nitrogen
    d. pure gold
24. Which of the following may have more than one phase?
   a. a pure solid
   b. a pure liquid
   c. a homogeneous mixture
   d. a heterogeneous mixture

25. Which of the following is true about homogeneous mixtures?
   a. They are known as solutions.
   b. They consist of two or more phases.
   c. They have compositions that never vary.
   d. They are always liquids.

26. Which of the following is a heterogeneous mixture?
   a. vinegar in water
   b. milk
   c. oil and vinegar
   d. air

27. Which of the following is true about compounds?
   a. They can be physically separated into their component elements.
   b. They have compositions that vary.
   c. They are substances.
   d. They have properties similar to those of their component elements.

28. Which of the following materials is a substance?
   a. air
   b. gasoline
   c. stainless steel
   d. silver

29. What is one difference between a mixture and a compound?
   a. A compound consists of more than one phase.
   b. A compound can only be separated into its components by chemical means.
   c. A mixture can only be separated into its components by chemical means.
   d. A mixture must be uniform in composition.

30. Which of the following is used for chemical symbols today?
   a. drawings
   b. icons
   c. letters
   d. numbers

31. The chemical formula of a compound indicates
   a. the source of the elements in the compound.
   b. how elements are joined in the compound.
   c. the alchemy symbols for the elements in the compound.
   d. the relative proportions of the elements in the compound.
32. Which substance has a chemical symbol that is derived from a Latin name?
   a. calcium
   b. hydrogen
   c. oxygen
   d. potassium

33. Which of the following is a chemical property?
   a. color
   b. hardness
   c. freezing point
   d. ability to react with oxygen

34. In the chemical reaction in which sucrose is heated and decomposes to form carbon dioxide and water, which of the following is a reactant?
   a. sucrose
   b. carbon dioxide
   c. water
   d. heat

35. What must occur for a change to be a chemical reaction?
   a. There must be a change in chemical properties.
   b. There must be a change in physical properties.
   c. The change must involve a change in mass.
   d. The change must involve a change in volume.

36. Which of the following changes to a metal is a chemical change?
   a. bending
   b. melting
   c. rusting
   d. polishing

37. Which of the following processes involves a change in physical properties?
   a. rusting
   b. fermenting
   c. boiling
   d. burning

38. Which of the following is a chemical property of water at 4°C?
   a. its color
   b. its state
   c. its temperature
   d. its ability to decompose into hydrogen and oxygen

39. When paper turns yellow-brown upon exposure to sunlight, what type of change is likely taking place?
   a. a physical change
   b. a chemical change
   c. neither a physical change nor a chemical change
   d. both a physical change and a chemical change
40. Which of the following indicates that a physical change has taken place?
   a. fracture formation
   b. gas production
   c. precipitate formation
   d. energy transfer

41. Which action changes the identity of the substance referenced?
   a. melting gold
   b. running an electric current through copper
   c. corroding iron
   d. breaking an ice cube

42. Which of the following is true for all chemical reactions?
   a. The total mass of the reactants increases.
   b. The total mass of the products is greater than the total mass of the reactants.
   c. The total mass of the products is less than the total mass of the reactants.
   d. The total mass of the reactants equals the total mass of the products.

43. What is the result of adding $2.5 \times 10^3$ and $3.5 \times 10^2$?
   a. $2.9 \times 10^3$
   b. $6.0 \times 10^3$
   c. $2.9 \times 10^2$
   d. $6.0 \times 10^5$

44. When a test instrument is calibrated, does its accuracy, precision, or reliability improve?
   a. precision
   b. accuracy
   c. reliability
   d. all of the above

45. Conversion factors are useful in solving problems in which a given measurement must be expressed in
   a. scientific notation.
   b. the correct number of significant digits.
   c. the correct precision.
   d. some other unit of measure.

46. Which of the following measurements is expressed to three significant figures?
   a. 0.007 m
   b. 7077 mg
   c. $7.30 \times 10^{-7}$ km
   d. 0.070 mm

47. Express the sum of 7.68 m and 5.0 m using the correct number of significant digits.
   a. 12.68 m
   b. 12.7 m
   c. 13 m
   d. 10 m
48. What is the metric system prefix for the quantity 0.000 001?
   a. centi-
   b. deci-
   c. kilo-
   d. micro-

49. If the temperature changes by 100 K, by how much does it change in °C?
   a. 0°C
   b. 37°
   c. 100°C
   d. 273°C

50. If a liter of water is heated from 20°C to 50°C, what happens to its volume?
   a. The volume decreases.
   b. The volume increases.
   c. The volume first increases, then decreases.
   d. The volume first decreases, then increases.

51. The density of mercury is 5,427 kg/(m³). If the density of water is 1.0 g/mL, will mercury float or sink in water?
   a. Mercury will float because the density of mercury is 0.005427 g/mL, which is less than the 1.0 g/mL density of water.
   b. Mercury will float because the density of mercury is 0.05427 g/mL, which is less than the 1.0 g/mL density of water.
   c. Mercury will sink because the density of mercury is 5.427 g/mL, which is greater than the 1.0 g/mL density of water.
   d. Mercury will sink because the density of mercury is 5,427 g/mL, which is greater than the 1.0 g/mL density of water.

52. Which discovery did J. J. Thomson make that improved upon Dalton's atomic theory?
   a. Atoms contain tiny, negatively charged electrons.
   b. Atoms are always in motion.
   c. Atoms contain a tiny, positively charged nucleus.
   d. Atoms that combine do so in simple whole-number ratios.

53. Which of the following was originally a tenet of Dalton's atomic theory, but had to be revised about a century ago?
   a. Atoms are tiny indivisible particles.
   b. The atoms of any one element are different from those of any other element.
   c. Compounds are made by combining atoms.
   d. Atoms of different elements can combine with one another in simple whole number ratios.

54. Evidence about Dalton’s atomic theory has shown that
   a. all of Dalton's hypotheses were correct.
   b. atoms of an element can have different numbers of protons.
   c. atoms are divisible.
   d. all atoms of an element are not identical but they must all have the same mass.
55. Which of the following is true about subatomic particles?
   a. Electrons are negatively charged and are the heaviest subatomic particle.
   b. Protons are positively charged and the lightest subatomic particle.
   c. Neutrons have no charge and are the lightest subatomic particle.
   d. The mass of a neutron nearly equals the mass of a proton.

56. What is the relative mass of an electron?
   a. $1/1840$ the mass of a hydrogen atom
   b. $1/1840$ the mass of a neutron + proton
   c. $1/1840$ the mass of a C-12 atom
   d. $1/1840$ the mass of an alpha particle

57. Which model of the atom is thought to be true?
   a. Protons, electrons, and neutrons are evenly distributed throughout the volume of the atom.
   b. The nucleus is made of protons, electrons, and neutrons.
   c. Electrons are distributed around the nucleus and occupy almost all the volume of the atom.
   d. The nucleus is made of electrons and protons.

58. The atomic number of an element is the total number of which particles in the nucleus?
   a. neutrons
   b. protons
   c. electrons
   d. protons and electrons

59. What does the number 84 in the name krypton-84 represent?
   a. the atomic number
   b. the mass number
   c. the sum of the protons and electrons
   d. twice the number of protons

60. Isotopes of the same element have different
   a. numbers of neutrons.
   b. numbers of protons.
   c. numbers of electrons.
   d. atomic numbers.

61. Isotopes of the same element have different
   a. positions on the periodic table.
   b. chemical behavior.
   c. atomic numbers.
   d. mass numbers.

62. Using the periodic table, determine the number of neutrons in $^{16}$O.
   a. 4
   b. 8
   c. 16
   d. 24
63. How many protons, electrons, and neutrons does an atom with atomic number 50 and mass number 125 contain?
   a. 50 protons, 50 electrons, 75 neutrons
   b. 75 electrons, 50 protons, 50 neutrons
   c. 120 neutrons, 50 protons, 75 electrons
   d. 70 neutrons, 75 protons, 50 electrons

64. Select the correct symbol for an atom of tritium.
   a. \(_{1}^{1}\text{n}\)
   b. \(_{1}^{1}\text{H}\)
   c. \(_{1}^{2}\text{H}\)
   d. \(_{1}^{3}\text{H}\)

65. What unit is used to measure weighted average atomic mass?
   a. amu
   b. gram
   c. angstrom
   d. nanogram

66. Which of the following equals one atomic mass unit?
   a. the mass of one electron
   b. the mass of one helium-4 atom
   c. the mass of one carbon-12 atom
   d. one-twelfth the mass of one carbon-12 atom

67. Why do chemists use relative masses of atoms compared to a reference isotope rather than the actual masses of the atoms?
   a. The actual mass of an electron is very large compared to the actual mass of a proton.
   b. The actual masses of atoms are very small and difficult to work with.
   c. The number of subatomic particles in atoms of different elements varies.
   d. The actual masses of protons, electrons, and neutrons are not known.

68. The principal quantum number indicates what property of an electron?
   a. position
   b. speed
   c. energy level
   d. electron cloud shape

69. What is the shape of the \(3p\) atomic orbital?
   a. sphere
   b. dumbbell
   c. bar
   d. two perpendicular dumbbells
70. How many energy sublevels are in the second principal energy level?
   a. 1
   b. 2
   c. 3
   d. 4

71. What is the maximum number of f orbitals in any single energy level in an atom?
   a. 1
   b. 3
   c. 5
   d. 7

72. If the spin of one electron in an orbital is clockwise, what is the spin of the other electron in that orbital?
   a. zero
   b. clockwise
   c. counterclockwise
   d. both clockwise and counterclockwise

73. What types of atomic orbitals are in the third principal energy level?
   a. s and p only
   b. p and d only
   c. s, p, and d only
   d. s, p, d, and f

74. According to the aufbau principle,
   a. an orbital may be occupied by only two electrons.
   b. electrons in the same orbital must have opposite spins.
   c. electrons enter orbitals of highest energy first.
   d. electrons enter orbitals of lowest energy first.

75. What is the number of electrons in the outermost energy level of an oxygen atom?
   a. 2
   b. 4
   c. 6
   d. 8

76. What is the electron configuration of potassium?
   a. 1s²2s²2p⁶3s²3p⁶4s¹
   b. 1s²2s²2p⁶3s²3p³
   c. 1s²2s²2p⁶3s²3p⁶3d¹
   d. 1s²2s²2p⁶3s²3p⁶4s¹

77. How many half-filled orbitals are in a bromine atom?
   a. 1
   b. 2
   c. 3
   d. 4
78. Stable electron configurations are likely to contain
   a. filled energy sublevels.
   b. fewer electrons than unstable configurations.
   c. unfilled s orbitals.
   d. electrons with a clockwise spin.

79. How does the speed of visible light compare with the speed of gamma rays, when both speeds are measured in a vacuum?
   a. The speed of visible light is greater.
   b. The speed of gamma rays is greater.
   c. The speeds are the same.
   d. No answer can be determined from the information given.

80. Which of the following electromagnetic waves have the highest frequencies?
   a. ultraviolet light waves
   b. X-rays
   c. microwaves
   d. gamma rays

81. How are the frequency and wavelength of light related?
   a. They are inversely proportional to each other.
   b. Frequency equals wavelength divided by the speed of light.
   c. Wavelength is determined by dividing frequency by the speed of light.
   d. They are directly proportional to each other.

82. As changes in energy levels of electrons increase, the frequencies of atomic line spectra they emit
   a. increase.
   b. decrease.
   c. remain the same.
   d. cannot be determined.

83. The atomic emission spectra of a sodium atom on Earth and of a sodium atom in the sun would be
   a. the same.
   b. different from each other.
   c. the same as those of several other elements.
   d. the same as each other only in the ultraviolet range.

84. What is the approximate frequency of a photon having an energy $5 \times 10^{-24}$ J? ($h = 6.6 \times 10^{-34}$ J·s)
   a. $8 \times 10^{9}$ Hz
   b. $3 \times 10^{-57}$ Hz
   c. $3 \times 10^{-58}$ Hz
   d. $1 \times 10^{-10}$ Hz

85. How do the energy differences between the higher energy levels of an atom compare with the energy differences between the lower energy levels of the atom?
   a. They are greater in magnitude than those between lower energy levels.
   b. They are smaller in magnitude than those between lower energy levels.
   c. There is no significant difference in the magnitudes of these differences.
   d. No answer can be determined from the information given.
86. Which scientist developed the quantum mechanical model of the atom?
   a. Albert Einstein
   b. Erwin Schrödinger
   c. Niels Bohr
   d. Ernest Rutherford

87. Bohr's model could only explain the spectra of which type of atoms?
   a. single atoms with one electron
   b. bonded atoms with one electron
   c. single atoms with more than one electron
   d. bonded atoms with more than one electron

88. The quantum mechanical model of the atom
   a. defines the exact path of an electron around the nucleus.
   b. was proposed by Niels Bohr.
   c. involves the probability of finding an electron in a certain position.
   d. no longer requires the concept of energy levels.

89. What is another name for the representative elements?
   a. Group A elements
   b. Group B elements
   c. Group C elements
   d. transition elements

90. What is another name for the transition metals?
   a. noble gases
   b. Group A elements
   c. Group B elements
   d. Group C elements

91. Who arranged the elements according to atomic mass and used the arrangement to predict the properties of missing elements?
   a. Henry Moseley
   b. Antoine Lavoisier
   c. John Dalton
   d. Dmitri Mendeleev

92. Which of the following categories includes the majority of the elements?
   a. metalloids
   b. liquids
   c. metals
   d. nonmetals

93. Of the elements Pt, V, Li, and Kr, which is a nonmetal?
   a. Pt
   b. V
   c. Li
   d. Kr
94. In which of the following sets is the symbol of the element, the number of protons, and the number of electrons given correctly?
   a. In, 49 protons, 49 electrons
   b. Zn, 30 protons, 60 electrons
   c. Cs, 55 protons, 132.9 electrons
   d. F, 19 protons, 19 electrons

95. The atomic number of an element is the total number of which particles in the nucleus?
   a. neutrons
   b. protons
   c. electrons
   d. protons and electrons

96. What element has the electron configuration $1s^22s^22p^63s^23p^2$?
   a. nitrogen
   b. selenium
   c. silicon
   d. silver

97. Which of the following is true about the electron configurations of the noble gases?
   a. The highest occupied $s$ and $p$ sublevels are completely filled.
   b. The highest occupied $s$ and $p$ sublevels are partially filled.
   c. The electrons with the highest energy are in a $d$ sublevel.
   d. The electrons with the highest energy are in an $f$ sublevel.

98. What are the Group 1A and Group 7A elements examples of?
   a. representative elements
   b. transition elements
   c. noble gases
   d. nonmetallic elements

99. Of the elements Fe, Hg, U, and Te, which is a representative element?
   a. Fe
   b. Hg
   c. U
   d. Te

100. How does atomic radius change from top to bottom in a group in the periodic table?
    a. It tends to decrease.
    b. It tends to increase.
    c. It first increases, then decreases.
    d. It first decreases, then increases.

101. What element in the second period has the largest atomic radius?
    a. carbon
    b. lithium
    c. potassium
    d. neon
102. The metals in Groups 1A, 2A, and 3A
   a. gain electrons when they form ions.
   b. all form ions with a negative charge.
   c. all have ions with a $1^+$ charge.
   d. lose electrons when they form ions.

103. Which of the following statements is true about ions?
   a. Anions are positively charged ions.
   b. Cations are common among nonmetals.
   c. Charges for ions are always written as numbers followed by a plus or minus sign.
   d. When an anion forms, more electrons are transferred to it.

104. What is the element with the lowest electronegativity value?
   a. cesium
   b. helium
   c. calcium
   d. fluorine

105. What is the element with the highest electronegativity value?
   a. cesium
   b. helium
   c. calcium
   d. fluorine

106. Which of the following elements has the smallest ionic radius?
   a. Li
   b. K
   c. O
   d. S

107. By the early 1800’s, chemists started organizing elements into groups because
   a. the printing press made it possible to disseminate knowledge faster.
   b. universities had a sudden influx of students interested in chemistry.
   c. there were so many new elements that had been discovered.
   d. more books were being published on the topic.

108. Which of the following factors contributes to the decrease in ionization energy within a group in the periodic table as the atomic number increases?
   a. increase in atomic size
   b. increase in size of the nucleus
   c. increase in number of protons
   d. fewer electrons in the highest occupied energy level

109. Which of the following elements has the smallest first ionization energy?
   a. sodium
   b. calcium
   c. potassium
   d. magnesium
110. Which of the following elements has the lowest electronegativity?
   a. lithium  
   b. carbon  
   c. bromine  
   d. fluorine

111. Which statement is true about electronegativity?
   a. Electronegativity is the ability of an anion to attract another anion.
   b. Electronegativity generally increases as you move from top to bottom within a group.
   c. Electronegativity generally is higher for metals than for nonmetals.
   d. Electronegativity generally increases from left to right across a period.

112. Which of the following decreases with increasing atomic number in Group 2A?
   a. shielding effect  
   b. ionic size  
   c. ionization energy  
   d. number of electrons

113. How many valence electrons are in an atom of phosphorus?
   a. 2  
   b. 3  
   c. 4  
   d. 5

114. How many valence electrons are in an atom of magnesium?
   a. 2  
   b. 3  
   c. 4  
   d. 5

115. What is the maximum charge an ion is likely to have?
   a. 2  
   b. 3  
   c. 4  
   d. 5

116. What is the electron configuration of the calcium ion?
   a. 1s²2s²2p⁶3s²3p⁶  
   b. 1s²2s²2p⁶3s²3p⁴4s²  
   c. 1s²2s²2p⁶3s²3p⁵4s¹  
   d. 1s²2s²2p⁶3s²

117. What is the charge on the strontium ion?
   a. 2–  
   b. 1–  
   c. 1+  
   d. 2+
118. How many electrons does silver have to give up in order to achieve a pseudo-noble-gas electron configuration?
   a. 1
   b. 2
   c. 3
   d. 4

119. Which of the following ions has a pseudo-noble-gas electron configuration?
   a. Fe$^{2+}$
   b. Mn$^{2+}$
   c. Cu$^+$
   d. Ni$^+$

120. Which of the following elements forms an ion with a 1− charge?
   a. fluorine
   b. hydrogen
   c. potassium
   d. sodium

121. What is the formula of the ion formed when tin achieves a stable electron configuration?
   a. Sn$^{4+}$
   b. Sn$^{3+}$
   c. Sn$^{2−}$
   d. Sn$^{4−}$

122. What is the formula of the ion formed when cadmium achieves a pseudo-noble-gas electron configuration?
   a. Cd$^{3+}$
   b. Cd$^{2+}$
   c. Cd$^+$
   d. Cd$^{2−}$

123. What is the electron configuration of the oxide ion (O$^{2−}$)?
   a. 1s$^2$2s$^2$2p$^4$
   b. 1s$^2$2s$^2$2p$^6$
   c. 1s$^2$2s$^2$
   d. 1s$^2$2s$^2$2p$^2$
124. What is the electron configuration of the iodide ion?
   a. 1s\(^2\)2s\(^2\)2p\(^6\)3s\(^2\)3p\(^6\)3d\(^10\)4s\(^2\)4p\(^6\)4d\(^10\)5s\(^2\)5p\(^6\)
   b. 1s\(^2\)2s\(^2\)2p\(^6\)3s\(^2\)3p\(^6\)3d\(^10\)4s\(^2\)4p\(^6\)4d\(^10\)
   c. 1s\(^2\)2s\(^2\)2p\(^6\)3s\(^2\)3p\(^6\)3d\(^10\)4s\(^2\)4p\(^6\)4d\(^10\)5s\(^2\)
   d. 1s\(^2\)2s\(^2\)2p\(^6\)3s\(^2\)3p\(^6\)3d\(^10\)4s\(^2\)4p\(^6\)

125. Which of the following occurs in an ionic bond?
   a. Oppositely charged ions attract.
   b. Two atoms share two electrons.
   c. Two atoms share more than two electrons.
   d. Like-charged ions attract.

126. What is the net charge of the ionic compound calcium fluoride?
   a. 2–
   b. 1–
   c. 0
   d. 1+

127. Which of the following is true about an ionic compound?
   a. The chemical formula shows the atoms in a molecule.
   b. The formula unit gives the number of each type of ions in a crystal.
   c. It is composed of anions and cations and yet it is electrically neutral.
   d. The chemical formula shows the ions in a molecule.

128. How many valence electrons are transferred from the nitrogen atom to potassium in the formation of the compound potassium nitride?
   a. 0
   b. 1
   c. 2
   d. 3

129. What is the formula unit of sodium nitride?
   a. NaN
   b. Na\(_2\)N
   c. Na\(_3\)N
   d. NaN\(_3\)

130. Ionic compounds are normally in which physical state at room temperature?
   a. solid
   b. liquid
   c. gas
   d. plasma
131. What does the term \textit{coordination number} in ionic crystals refer to?
   a. the total number of valence electrons in an atom
   b. the number of oppositely charged ions surrounding a particular ion
   c. the number of atoms in a particular formula unit
   d. the number of like-charged ions surrounding a particular ion

132. Under what conditions can potassium bromide conduct electricity?
   a. only when melted
   b. only when dissolved
   c. only when it is in crystal form
   d. only when melted or dissolved in water

133. What is the basis of a metallic bond?
   a. the attraction of metal ions to mobile electrons
   b. the attraction between neutral metal atoms
   c. the neutralization of protons by electrons
   d. the attraction of oppositely charged ions

134. What characteristic of metals makes them good electrical conductors?
   a. They have mobile valence electrons.
   b. They have mobile protons.
   c. They have mobile cations.
   d. Their crystal structures can be rearranged easily.

135. Which metallic crystal structure has a coordination number of 8?
   a. body-centered cubic
   b. face-centered cubic
   c. hexagonal close-packing
   d. tetragonal

136. What information does a molecular formula provide?
   a. the number and kind of atoms that are bonded by the transfer of electrons
   b. the simplest whole-number ratio of atoms that are bonded by the transfer of electrons
   c. information about a molecule’s structure
   d. the number and kind of atoms present in a molecule

137. What is shown by the structural formula of a molecule or polyatomic ion?
   a. the arrangement of bonded atoms
   b. the number of ionic bonds
   c. the number of metallic bonds
   d. the shapes of molecular orbitals

138. How do atoms achieve noble-gas electron configurations in single covalent bonds?
   a. One atom completely loses two electrons to the other atom in the bond.
   b. Two atoms share two pairs of electrons.
   c. Two atoms share two electrons.
   d. Two atoms share one electron.
139. Which noble gas has the same electron configuration as the oxygen in a water molecule?
   a. helium
   b. neon
   c. argon
   d. xenon

140. What is the representative unit in a molecular compound?
   a. a molecule
   b. an ion
   c. a formula unit
   d. shared electrons

141. Which of the following diatomic molecules is joined by a double covalent bond?
   a. O₂
   b. Cl₂
   c. N₂
   d. He₂

142. Once formed, how are coordinate covalent bonds different from other covalent bonds?
   a. They are stronger.
   b. They are more ionic in character.
   c. They are weaker.
   d. There is no difference.

143. Which of the following bonds is the least reactive?
   a. C—C
   b. H—H
   c. O—H
   d. H—Cl

144. In which of the following compounds is the octet expanded to include 12 electrons?
   a. H₂S
   b. PCl₃
   c. PCl₅
   d. SF₆

145. A resonance structure, like the one above, represents
   a. a difference in energy.
   b. electron pairs resonating back and forth between the extremes of the two structures.
   c. a difference in bond length, one shorter than the other.
   d. a hybrid of the extremes represented by the resonance forms.
146. Which of the following atoms acquires the most negative charge in a covalent bond with hydrogen?
   a. C
   b. Na
   c. O
   d. S

147. Which of the following covalent bonds is the most polar?
   a. H—F
   b. H—C
   c. H—H
   d. H—N

148. What is thought to cause the dispersion forces?
   a. attraction between ions
   b. motion of electrons
   c. sharing of electron pairs
   d. differences in electronegativity

149. What causes dipole interactions?
   a. sharing of electron pairs
   b. attraction between polar molecules
   c. bonding of a covalently bonded hydrogen to an unshared electron pair
   d. attraction between ions

150. Why is hydrogen bonding only possible with hydrogen?
   a. Hydrogen’s nucleus is electron deficient when it bonds with an electronegative atom.
   b. Hydrogen is the only atom that is the same size as an oxygen atom.
   c. Hydrogen is the most electronegative element.
   d. Hydrogen tends to form covalent bonds.

151. Which type of solid has the highest melting point?
   a. ionic solid
   b. network solid
   c. metal
   d. nonmetallic solid

152. What type of ions have names ending in -ide?
   a. only cations
   b. only anions
   c. only metal ions
   d. only gaseous ions

153. In which of the following are the symbol and name for the ion given correctly?
   a. Fe$^{2+}$: ferrous ion; Fe$^{3+}$: ferric ion
   b. Sn$^{2+}$: stannic ion; Sn$^{4+}$: stannous ion
   c. Co$^{2+}$: cobalt(II) ion; Co$^{3+}$: cobaltous ion
   d. Pb$^{2+}$: lead ion; Pb$^{4+}$: lead(IV) ion
154. Which of the following correctly provides the name of the element, the symbol for the ion, and the name of the ion?
   a. fluorine, F\(^+\), fluoride ion
   b. zinc, Zn\(^{2+}\), zincate ion
   c. copper, Cu\(^+\), cuprous ion
   d. sulfur, S\(^{2-}\), sulfurous ion

155. Which of the following determines that an element is a metal?
   a. the magnitude of its charge
   b. the molecules that it forms
   c. when it is a Group A element
   d. whether it loses valence electrons

156. What is the Stock name for chromic ion?
   a. chromium(I) ion
   b. chromium(II) ion
   c. chromium(III) ion
   d. chromium(IV) ion

157. Which of the following is a cation?
   a. SO\(_3\)^{2-}
   b. sulfate
   c. Ca\(^{2+}\)
   d. chlorite

158. In which of the following are the symbol and name for both of the ions given correctly?
   a. NH\(_4\)^+ : ammonia; H\(^+\) : hydride
   b. C\(_2\)H\(_3\)O\(_2\) : acetate; C\(_2\)O\(_4\)^- : oxalite
   c. OH^- : hydroxide; O\(^2-\) : oxide
   d. PO\(_3\)^{3-} : phosphate; PO\(_4\)^{3-} : phosphite

159. An -ate or -ite at the end of a compound name usually indicates that the compound contains
   a. fewer electrons than protons.
   b. neutral molecules.
   c. only two elements.
   d. a polyatomic anion.

160. How are chemical formulas of binary ionic compounds generally written?
   a. cation on left, anion on right
   b. anion on left, cation on right
   c. Roman numeral first, then anion, then cation
   d. subscripts first, then ions
161. Which of the following is true about the composition of ionic compounds?
   a. They are composed of anions and cations.
   b. They are composed of anions only.
   c. They are composed of cations only.
   d. They are formed from two or more nonmetallic elements.

162. Which of the following formulas represent an ionic compound?
   a. CS₂
   b. BaI₂
   c. N₂O₄
   d. PCl₃

163. Which of the following shows correctly an ion pair and the ionic compound the two ions form?
   a. Sn⁴⁺, N³⁻; Sn₄N₃
   b. Cu²⁺, O²⁻; Cu₂O₂
   c. Cr³⁺, I⁻; CrI
   d. Fe³⁺, O²⁻; Fe₂O₃

164. In which of the following is the name and formula given correctly?
   a. sodium oxide, NaO
   b. barium nitride, BaN
   c. cobaltous chloride, CoCl₃
   d. stannic fluoride, SnF₄

165. Which set of chemical name and chemical formula for the same compound is correct?
   a. iron(II) oxide, Fe₂O₃
   b. aluminum fluorate, AlF₃
   c. tin(IV) bromide, SnBr₄
   d. potassium chloride, K₂Cl₂

166. What is the correct formula for potassium sulfite?
   a. KHSO₃
   b. KHSO₄
   c. K₂SO₃
   d. K₂SO₄

167. Which set of chemical name and chemical formula for the same compound is correct?
   a. ammonium sulfite, (NH₄)₂S
   b. iron(III) phosphate, FePO₄
   c. lithium carbonate, LiCO₃
   d. magnesium dichromate, MgCrO₄
168. Sulfur hexafluoride is an example of a
   a. monatomic ion.
   b. polyatomic ion.
   c. binary compound.
   d. polyatomic compound.

169. Molecular compounds are usually
   a. composed of two or more transition elements.
   b. composed of positive and negative ions.
   c. composed of two or more nonmetallic elements.
   d. exceptions to the law of definite proportions.

170. Which of the following is a binary molecular compound?
   a. BeHCO₃
   b. PCl₅
   c. AgI
   d. MgS

171. Consider a mystery compound having the formula MₓTᵧ. If the compound is not an acid, if it contains only
   two elements, and if M is not a metal, which of the following is true about the compound?
   a. It contains a polyatomic ion.
   b. Its name ends in -ite or -ate.
   c. Its name ends in -ic.
   d. It is a binary molecular compound.

172. Which of the following shows both the correct formula and correct name of an acid?
   a. HClO₂, chloric acid
   b. HNO₂, hydronitrous acid
   c. H₃PO₄, phosphoric acid
   d. HI, iodic acid

173. What is the formula for sulfurous acid?
   a. H₂SO₄
   b. H₂SO₃
   c. H₂SO₂
   d. H₂S

174. What is the formula for hydrosulfuric acid?
   a. H₂S₂
   b. H₂SO₂
   c. HSO₂
   d. H₂S
175. How are bases named?
   a. like monatomic elements
   b. like polyatomic ions
   c. like ionic compounds
   d. like molecular compounds

176. Which of the following pairs of substances best illustrates the law of multiple proportions?
   a. H₂ and O₂
   b. P₂O₅ and PH₃
   c. CaCl₂ and CaBr₂
   d. NO and NO₂

177. Select the correct formula for sulfur hexafluoride.
   a. S₂F₆
   b. F₆SO₃
   c. F₆S₂
   d. SF₆

178. What is the correct name for the compound CoCl₂?
   a. cobalt(I) chlorate
   b. cobalt(I) chloride
   c. cobalt(II) chlorate
   d. cobalt(II) chloride

179. Suppose you encounter a chemical formula with H as the cation. What do you know about this compound immediately?
   a. It is a polyatomic ionic compound.
   b. It is an acid.
   c. It is a base.
   d. It has a +1 charge.

180. What is the correct formula for barium chlorate?
   a. Ba(ClO)₂
   b. Ba(ClO₂)₂
   c. Ba(ClO₃)₂
   d. BaCl₂

181. What does an -ite or -ate ending in a polyatomic ion mean?
   a. Oxygen is in the formula.
   b. Sulfur is in the formula.
   c. Nitrogen is in the formula.
   d. Bromine is in the formula.
MULTIPLE CHOICE

1. ANS: C  PTS: 1  DIF: L1  REF: p. 3  OBJ: 1.1.1 Explain why the scope of chemistry is so vast.  BLM: knowledge
2. ANS: B  PTS: 1  DIF: L2  REF: p. 2  OBJ: 1.1.1 Explain why the scope of chemistry is so vast.  BLM: analysis
3. ANS: B  PTS: 1  DIF: L2  REF: p. 3  OBJ: 1.1.2 Identify five traditional areas of study in chemistry.  BLM: analysis
4. ANS: B  PTS: 1  DIF: L2  REF: p. 6 | p. 7  OBJ: 1.2.1 Identify three general reasons to study chemistry.  BLM: analysis
5. ANS: C  PTS: 1  DIF: L2  REF: p. 10  OBJ: 1.2.2 Identify some outcomes of modern research in chemistry.  BLM: application
6. ANS: B  PTS: 1  DIF: L2  REF: p. 22  OBJ: 1.4.1 Identify the general approach to solving a problem.  BLM: comprehension
7. ANS: C  PTS: 1  DIF: L2  REF: p. 5  OBJ: 1.1.3 Identify the central themes of chemistry.  BLM: comprehension
8. ANS: A  PTS: 1  DIF: L1  REF: p. 15  OBJ: 1.3.1 Describe how Lavoisier transformed chemistry.  BLM: knowledge
9. ANS: B  PTS: 1  DIF: L2  REF: p. 4  OBJ: 1.1.3 Identify the central themes of chemistry.  BLM: comprehension
10. ANS: A  PTS: 1  DIF: L2  REF: p. 6 | p. 7  OBJ: 1.2.1 Identify three general reasons to study chemistry.  BLM: analysis
11. ANS: D  PTS: 1  DIF: L2  REF: p. 25  OBJ: 1.4.3 Describe the steps for solving nonnumeric problems.  BLM: analysis
12. ANS: B  PTS: 1  DIF: L1  REF: p. 46  OBJ: 2.3.4 Explain how a periodic table is useful.  BLM: knowledge
13. ANS: B  PTS: 1  DIF: L2  REF: p. 34  OBJ: 2.1.1 Explain why all samples of a substance have the same intensive properties.  BLM: application
14. ANS: C  PTS: 1  DIF: L2  REF: p. 35  OBJ: 2.1.1 Explain why all samples of a substance have the same intensive properties.  BLM: application
15. ANS: D  PTS: 1  DIF: L2  REF: p. 35  OBJ: 2.1.1 Explain why all samples of a substance have the same intensive properties.  BLM: application
16. ANS: C  PTS: 1  DIF: L2  REF: p. 37  OBJ: 2.1.3 Classify physical changes.  BLM: comprehension
17. ANS: D  PTS: 1  DIF: L2  REF: p. 37  OBJ: 2.1.2 Identify the three states of matter.  BLM: comprehension
18. ANS: C  PTS: 1  DIF: L2  REF: p. 37  OBJ: 2.1.2 Identify the three states of matter.  BLM: comprehension
19. ANS: B  PTS: 1  DIF: L2  REF: p. 36
OBJ: 2.1.2 Identify the three states of matter.  BLM: comprehension

20. ANS: C  PTS: 1  DIF: L2  REF: p. 37
OBJ: 2.1.2 Identify the three states of matter.  BLM: comprehension

21. ANS: A  PTS: 1  DIF: L2  REF: p. 36
OBJ: 2.1.2 Identify the three states of matter.  BLM: comprehension

22. ANS: C  PTS: 1  DIF: L2  REF: p. 37
OBJ: 2.1.3 Classify physical changes.  BLM: application

23. ANS: B  PTS: 1  DIF: L2  REF: p. 36 | p. 44
OBJ: 2.3.1 Explain the difference between an element and a compound.  2.3.2 Distinguish between a substance and a mixture.  BLM: application

24. ANS: D  PTS: 1  DIF: L2  REF: p. 39
OBJ: 2.2.1 Explain how mixtures are classified.  BLM: comprehension

25. ANS: A  PTS: 1  DIF: L2  REF: p. 39
OBJ: 2.2.1 Explain how mixtures are classified.  BLM: comprehension

26. ANS: C  PTS: 1  DIF: L2  REF: p. 39
OBJ: 2.2.1 Explain how mixtures are classified.  BLM: application

27. ANS: C  PTS: 1  DIF: L2  REF: p. 44
OBJ: 2.3.2 Distinguish between a substance and a mixture.  BLM: comprehension

28. ANS: D  PTS: 1  DIF: L2  REF: p. 44
OBJ: 2.3.2 Distinguish between a substance and a mixture.  BLM: application

29. ANS: B  PTS: 1  DIF: L2  REF: p. 44
OBJ: 2.3.2 Distinguish between a substance and a mixture.  BLM: application

30. ANS: C  PTS: 1  DIF: L1  REF: p. 45
OBJ: 2.3.3 Describe what chemists use to represent elements and compounds.  BLM: knowledge

31. ANS: D  PTS: 1  DIF: L2  REF: p. 46
OBJ: 2.3.3 Describe what chemists use to represent elements and compounds.  BLM: comprehension

32. ANS: D  PTS: 1  DIF: L2  REF: p. 46
OBJ: 2.3.3 Describe what chemists use to represent elements and compounds.  BLM: comprehension

33. ANS: D  PTS: 1  DIF: L2  REF: p. 48
OBJ: 2.4.1 Describe what happens during a chemical change.  BLM: comprehension

34. ANS: A  PTS: 1  DIF: L2  REF: p. 48
OBJ: 2.4.1 Describe what happens during a chemical change.  BLM: application

35. ANS: A  PTS: 1  DIF: L2  REF: p. 48
OBJ: 2.4.1 Describe what happens during a chemical change.  BLM: comprehension

36. ANS: C  PTS: 1  DIF: L2  REF: p. 48
OBJ: 2.4.1 Describe what happens during a chemical change.  BLM: comprehension

37. ANS: C  PTS: 1  DIF: L1  REF: p. 37 | p. 49
OBJ: 2.1.3 Classify physical changes.  2.4.2 Identify four possible clues that a chemical change has taken place.  BLM: knowledge

38. ANS: D  PTS: 1  DIF: L2  REF: p. 48
OBJ: 2.4.1 Describe what happens during a chemical change.  BLM: comprehension
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<td><strong>OBJ:</strong></td>
<td>2.4.2 Identify four possible clues that a chemical change has taken place.</td>
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<td><strong>OBJ:</strong></td>
<td>3.1.1 Write numbers in scientific notation.</td>
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<td><strong>OBJ:</strong></td>
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57. ANS: C  PTS: 1  DIF: L2  REF: p. 109
OBJ: 4.2.2 Describe the structure of atoms according to the Rutherford model.
BLM: comprehension

58. ANS: B  PTS: 1  DIF: L1  REF: p. 112
OBJ: 4.3.1 Explain what makes one element different from another.
BLM: knowledge

59. ANS: B  PTS: 1  DIF: L2  REF: p. 115
OBJ: 4.3.2 Explain how isotopes of an element differ.  BLM: application

60. ANS: A  PTS: 1  DIF: L1  REF: p. 114
OBJ: 4.3.2 Explain how isotopes of an element differ.  BLM: knowledge

61. ANS: D  PTS: 1  DIF: L1  REF: p. 114
OBJ: 4.3.2 Explain how isotopes of an element differ.  BLM: knowledge

62. ANS: B  PTS: 1  DIF: L2  REF: p. 113
OBJ: 4.3.1 Explain what makes one element different from another.
BLM: analysis

63. ANS: A  PTS: 1  DIF: L2  REF: p. 113
OBJ: 4.3.1 Explain what makes one element different from another.
BLM: analysis

64. ANS: D  PTS: 1  DIF: L2  REF: p. 115
OBJ: 4.3.2 Explain how isotopes of an element differ.  BLM: comprehension

65. ANS: A  PTS: 1  DIF: L1  REF: p. 116
OBJ: 4.3.3 Calculate the atomic mass of an element.  BLM: knowledge

66. ANS: D  PTS: 1  DIF: L1  REF: p. 116
OBJ: 4.3.3 Calculate the atomic mass of an element.  BLM: knowledge

67. ANS: B  PTS: 1  DIF: L2  REF: p. 116
OBJ: 4.3.3 Calculate the atomic mass of an element.  BLM: comprehension

68. ANS: C  PTS: 1  DIF: L2  REF: p. 131
OBJ: 5.1.3 Explain how sublevels of principal energy levels differ.
BLM: comprehension

69. ANS: B  PTS: 1  DIF: L2  REF: p. 131
OBJ: 5.1.3 Explain how sublevels of principal energy levels differ.
BLM: comprehension

70. ANS: B  PTS: 1  DIF: L2  REF: p. 132
OBJ: 5.1.3 Explain how sublevels of principal energy levels differ.
BLM: comprehension

71. ANS: D  PTS: 1  DIF: L2  REF: p. 132
OBJ: 5.1.3 Explain how sublevels of principal energy levels differ.
BLM: comprehension

72. ANS: C  PTS: 1  DIF: L2  REF: p. 134
OBJ: 5.2.1 List the three rules for writing the electron configurations of elements.
BLM: comprehension

73. ANS: C  PTS: 1  DIF: L2  REF: p. 132
OBJ: 5.1.3 Explain how sublevels of principal energy levels differ.
BLM: comprehension

74. ANS: D  PTS: 1  DIF: L2  REF: p. 134
OBJ: 5.2.1 List the three rules for writing the electron configurations of elements.
BLM: comprehension
75. ANS: C PTS: 1 DIF: L2 REF: p. 135 | p. 136
OBJ: 5.2.1 List the three rules for writing the electron configurations of elements.
BLM: application

76. ANS: D PTS: 1 DIF: L2 REF: p. 135 | p. 136
OBJ: 5.2.1 List the three rules for writing the electron configurations of elements.
BLM: application

77. ANS: A PTS: 1 DIF: L3 REF: p. 135 | p. 136
OBJ: 5.2.1 List the three rules for writing the electron configurations of elements.
BLM: analysis

78. ANS: A PTS: 1 DIF: L2 REF: p. 137
OBJ: 5.2.1 List the three rules for writing the electron configurations of elements.
BLM: comprehension

79. ANS: C PTS: 1 DIF: L2 REF: p. 139
OBJ: 5.3.1 Explain what causes atomic emission spectra.
BLM: analysis

80. ANS: D PTS: 1 DIF: L2 REF: p. 139
OBJ: 5.3.1 Explain what causes atomic emission spectra.
BLM: comprehension

81. ANS: A PTS: 1 DIF: L1 REF: p. 138 | p. 139
OBJ: 5.3.1 Explain what causes atomic emission spectra.
BLM: knowledge

82. ANS: A PTS: 1 DIF: L2 REF: p. 145
OBJ: 5.3.3 Explain how the frequencies of light are related to changes in electron energies.
BLM: comprehension

83. ANS: A PTS: 1 DIF: L2 REF: p. 140
OBJ: 5.3.1 Explain what causes atomic emission spectra.
BLM: comprehension

84. ANS: A PTS: 1 DIF: L2 REF: p. 143 | p. 144
OBJ: 5.3.2 Describe how Einstein explained the photoelectric effect.
BLM: analysis

85. ANS: B PTS: 1 DIF: L3 REF: p. 129
OBJ: 5.1.1 Describe what Bohr proposed in his model of the atom.
BLM: comprehension

86. ANS: B PTS: 1 DIF: L1 REF: p. 130
OBJ: 5.1.2 Describe what the quantum mechanical model determines about the electrons in an atom.
BLM: knowledge

87. ANS: A PTS: 1 DIF: L2 REF: p. 129
OBJ: 5.1.1 Describe what Bohr proposed in his model of the atom.
BLM: comprehension

88. ANS: C PTS: 1 DIF: L2 REF: p. 130
OBJ: 5.1.2 Describe what the quantum mechanical model determines about the electrons in an atom.
BLM: comprehension

89. ANS: A PTS: 1 DIF: L2 REF: p. 171
OBJ: 6.2.2 Classify elements based on electron configuration.
BLM: comprehension

90. ANS: C PTS: 1 DIF: L1 REF: p. 172
OBJ: 6.2.2 Classify elements based on electron configuration.
BLM: knowledge

91. ANS: D PTS: 1 DIF: L1 REF: p. 161
OBJ: 6.1.2 Describe how Mendeleev organized his periodic table.
BLM: knowledge

92. ANS: C PTS: 1 DIF: L1 REF: p. 164
OBJ: 6.1.4 Identify three broad classes of elements.
BLM: knowledge
93. **ANS: D**  
   **PTS: 1**  
   **DIF: L2**  
   **REF: p. 165**  
   **OBJ: 6.1.4 Identify three broad classes of elements.**  
   **BLM: application**

94. **ANS: A**  
   **PTS: 1**  
   **DIF: L2**  
   **REF: p. 167**  
   **OBJ: 6.2.1 List the types of information that can be displayed in a periodic table.**  
   **BLM: application**

95. **ANS: B**  
   **PTS: 1**  
   **DIF: L1**  
   **REF: p. 162**  
   **OBJ: 6.1.3 Describe how the modern periodic table is organized.**  
   **BLM: knowledge**

96. **ANS: C**  
   **PTS: 1**  
   **DIF: L2**  
   **REF: p. 171**  
   **OBJ: 6.2.2 Classify elements based on electron configuration.**  
   **BLM: application**

97. **ANS: A**  
   **PTS: 1**  
   **DIF: L2**  
   **REF: p. 170**  
   **OBJ: 6.2.2 Classify elements based on electron configuration.**  
   **BLM: comprehension**

98. **ANS: A**  
   **PTS: 1**  
   **DIF: L2**  
   **REF: p. 171**  
   **OBJ: 6.2.2 Classify elements based on electron configuration.**  
   **BLM: comprehension**

99. **ANS: D**  
   **PTS: 1**  
   **DIF: L2**  
   **REF: p. 172**  
   **OBJ: 6.2.2 Classify elements based on electron configuration.**  
   **BLM: application**

100. **ANS: B**  
    **PTS: 1**  
    **DIF: L1**  
    **REF: p. 174**  
    **OBJ: 6.3.1 Describe trends among elements for atomic size.**  
    **BLM: knowledge**

101. **ANS: B**  
    **PTS: 1**  
    **DIF: L2**  
    **REF: p. 174 p. 175**  
    **OBJ: 6.3.1 Describe trends among elements for atomic size.**  
    **BLM: comprehension**

102. **ANS: D**  
    **PTS: 1**  
    **DIF: L2**  
    **REF: p. 176**  
    **OBJ: 6.3.2 Explain how ions form.**  
    **BLM: comprehension**

103. **ANS: D**  
    **PTS: 1**  
    **DIF: L2**  
    **REF: p. 176**  
    **OBJ: 6.3.2 Explain how ions form.**  
    **BLM: comprehension**

104. **ANS: A**  
    **PTS: 1**  
    **DIF: L2**  
    **REF: p. 181**  
    **OBJ: 6.3.3 Describe periodic trends for first ionization energy, ionic size, and electronegativity.**  
    **BLM: comprehension**

105. **ANS: D**  
    **PTS: 1**  
    **DIF: L2**  
    **REF: p. 181**  
    **OBJ: 6.3.3 Describe periodic trends for first ionization energy, ionic size, and electronegativity.**  
    **BLM: comprehension**

106. **ANS: A**  
    **PTS: 1**  
    **DIF: L2**  
    **REF: p. 179**  
    **OBJ: 6.3.3 Describe periodic trends for first ionization energy, ionic size, and electronegativity.**  
    **BLM: application**

107. **ANS: C**  
    **PTS: 1**  
    **DIF: L2**  
    **REF: p. 160**  
    **OBJ: 6.1.1 Explain how chemists began to organize the known elements.**  
    **BLM: comprehension**

108. **ANS: A**  
    **PTS: 1**  
    **DIF: L2**  
    **REF: p. 178**  
    **OBJ: 6.3.3 Describe periodic trends for first ionization energy, ionic size, and electronegativity.**  
    **BLM: comprehension**

109. **ANS: C**  
    **PTS: 1**  
    **DIF: L2**  
    **REF: p. 177 p. 178**  
    **OBJ: 6.3.3 Describe periodic trends for first ionization energy, ionic size, and electronegativity.**  
    **BLM: application**

110. **ANS: A**  
    **PTS: 1**  
    **DIF: L2**  
    **REF: p. 181**  
    **OBJ: 6.3.3 Describe periodic trends for first ionization energy, ionic size, and electronegativity.**  
    **BLM: application**
111. ANS: D
PT: 1
DIF: L2
REF: p. 181
OBJ: 6.3.3 Describe periodic trends for first ionization energy, ionic size, and electronegativity.
BLM: comprehension

112. ANS: C
PT: 1
DIF: L2
REF: p. 175 | p. 182
OBJ: 6.3.1 Describe trends among elements for atomic size. | 6.3.3 Describe periodic trends for first
ionization energy, ionic size, and electronegativity.
BLM: comprehension

113. ANS: D
PT: 1
DIF: L2
REF: p. 194 | p. 195
OBJ: 7.1.1 Determine the number of valence electrons in an atom of a representative element.
BLM: application

114. ANS: A
PT: 1
DIF: L2
REF: p. 197
OBJ: 7.1.1 Determine the number of valence electrons in an atom of a representative element.
BLM: application

115. ANS: B
PT: 1
DIF: L2
REF: p. 198
OBJ: 7.1.2 Identify the atoms of elements that tend to lose and tend to gain electrons.
BLM: comprehension

116. ANS: A
PT: 1
DIF: L2
REF: p. 196 | p. 197
OBJ: 7.1.2 Identify the atoms of elements that tend to lose and tend to gain electrons.
BLM: application

117. ANS: D
PT: 1
DIF: L2
REF: p. 197
OBJ: 7.1.2 Identify the atoms of elements that tend to lose and tend to gain electrons.
BLM: application

118. ANS: A
PT: 1
DIF: L2
REF: p. 197
OBJ: 7.1.3 Describe how cations form.
BLM: application

119. ANS: C
PT: 1
DIF: L1
REF: p. 197
OBJ: 7.1.3 Describe how cations form.
BLM: knowledge

120. ANS: A
PT: 1
DIF: L2
REF: p. 199
OBJ: 7.1.4 Explain how anions form.
BLM: comprehension

121. ANS: A
PT: 1
DIF: L2
REF: p. 197
OBJ: 7.1.3 Describe how cations form.
BLM: application

122. ANS: B
PT: 1
DIF: L2
REF: p. 197
OBJ: 7.1.3 Describe how cations form.
BLM: application

123. ANS: B
PT: 1
DIF: L2
REF: p. 198
OBJ: 7.1.4 Explain how anions form.
BLM: application

124. ANS: A
PT: 1
DIF: L2
REF: p. 198 | p. 199
OBJ: 7.1.4 Explain how anions form.
BLM: application

125. ANS: A
PT: 1
DIF: L1
REF: p. 201
OBJ: 7.2.1 Explain the electrical charge of an ionic compound.
BLM: knowledge

126. ANS: C
PT: 1
DIF: L1
REF: p. 201
OBJ: 7.2.1 Explain the electrical charge of an ionic compound.
BLM: knowledge

127. ANS: C
PT: 1
DIF: L2
REF: p. 201 | p. 202
OBJ: 7.2.1 Explain the electrical charge of an ionic compound.
BLM: comprehension

128. ANS: A
PT: 1
DIF: L2
REF: p. 201 | p. 202 | p. 203
OBJ: 7.2.1 Explain the electrical charge of an ionic compound.
BLM: analysis

129. ANS: C
PT: 1
DIF: L2
REF: p. 201 | p. 202 | p. 203
OBJ: 7.2.1 Explain the electrical charge of an ionic compound.
BLM: analysis

130. ANS: A
PT: 1
DIF: L1
REF: p. 204
OBJ: 7.2.2 Describe three properties of ionic compounds.
BLM: knowledge
131. **ANS:** B  
**PTS:** 1  
**DIF:** L1  
**REF:** p. 205  
**OBJ:** 7.2.2 Describe three properties of ionic compounds.  
**BLM:** knowledge

132. **ANS:** D  
**PTS:** 1  
**DIF:** L1  
**REF:** p. 206  
**OBJ:** 7.2.2 Describe three properties of ionic compounds.  
**BLM:** knowledge

133. **ANS:** A  
**PTS:** 1  
**DIF:** L2  
**REF:** p. 209  
**OBJ:** 7.3.1 Model the valence electrons of metal atoms.  
**BLM:** comprehension

134. **ANS:** A  
**PTS:** 1  
**DIF:** L2  
**REF:** p. 209  
**OBJ:** 7.3.1 Model the valence electrons of metal atoms.  
**BLM:** comprehension

135. **ANS:** A  
**PTS:** 1  
**DIF:** L2  
**REF:** p. 205 | p. 210  
**OBJ:** 7.3.2 Describe the arrangement of atoms in a metal.  
**BLM:** comprehension

136. **ANS:** D  
**PTS:** 1  
**DIF:** L2  
**REF:** p. 222  
**OBJ:** 8.1.1 Identify the information a molecular formula provides.  
**BLM:** comprehension

137. **ANS:** A  
**PTS:** 1  
**DIF:** L1  
**REF:** p. 227  
**OBJ:** 8.2.1 Explain the result of electron sharing in covalent bonds.  
**BLM:** comprehension

138. **ANS:** C  
**PTS:** 1  
**DIF:** L2  
**REF:** p. 226  
**OBJ:** 8.2.1 Explain the result of electron sharing in covalent bonds.  
**BLM:** comprehension

139. **ANS:** B  
**PTS:** 1  
**DIF:** L2  
**REF:** p. 227  
**OBJ:** 8.2.1 Explain the result of electron sharing in covalent bonds.  
**BLM:** application

140. **ANS:** A  
**PTS:** 1  
**DIF:** L2  
**REF:** p. 226  
**OBJ:** 8.1.2 Describe the representative units that define molecular compounds and ionic compounds.  
**BLM:** comprehension

141. **ANS:** A  
**PTS:** 1  
**DIF:** L2  
**REF:** p. 230  
**OBJ:** 8.2.1 Explain the result of electron sharing in covalent bonds.  
**BLM:** application

142. **ANS:** D  
**PTS:** 1  
**DIF:** L2  
**REF:** p. 232  
**OBJ:** 8.2.2 Describe how coordinate covalent bonds are different from other covalent bonds.  
**BLM:** comprehension

143. **ANS:** B  
**PTS:** 1  
**DIF:** L2  
**REF:** p. 236 | p. 237  
**OBJ:** 8.2.4 Explain how the strength of a covalent bond is related to its bond dissociation energy.  
**BLM:** application

144. **ANS:** D  
**PTS:** 1  
**DIF:** L2  
**REF:** p. 235  
**OBJ:** 8.2.3 Identify some exceptions to the octet rule.  
**BLM:** application

145. **ANS:** D  
**PTS:** 1  
**DIF:** L2  
**REF:** p. 237  
**OBJ:** 8.2.5 Describe how resonance structures are used.  
**BLM:** comprehension

146. **ANS:** C  
**PTS:** 1  
**DIF:** L2  
**REF:** p. 248 | p. 249  
**OBJ:** 8.4.1 Describe how electronegativity values determine the charge distribution in a polar molecule.  
**BLM:** application

147. **ANS:** A  
**PTS:** 1  
**DIF:** L3  
**REF:** p. 248 | p. 249  
**OBJ:** 8.4.1 Describe how electronegativity values determine the charge distribution in a polar molecule.  
**BLM:** application

148. **ANS:** B  
**PTS:** 1  
**DIF:** L1  
**REF:** p. 251  
**OBJ:** 8.4.2 Evaluate the strengths of intermolecular attractions compared with the strengths of ionic and covalent bonds.  
**BLM:** knowledge
149. ANS: B  
OBJ: 8.4.2 Evaluate the strengths of intermolecular attractions compared with the strengths of ionic and covalent bonds. BLM: knowledge

150. ANS: A  
OBJ: 8.4.2 Evaluate the strengths of intermolecular attractions compared with the strengths of ionic and covalent bonds. BLM: comprehension

151. ANS: B  
OBJ: 8.4.3 Explain why the properties of covalent compounds are so diverse. BLM: knowledge

152. ANS: B  
OBJ: 9.1.1 Explain how to determine the charges of monatomic ions. BLM: comprehension

153. ANS: A  
OBJ: 9.1.1 Explain how to determine the charges of monatomic ions. BLM: application

154. ANS: C  
OBJ: 9.1.1 Explain how to determine the charges of monatomic ions. BLM: application

155. ANS: D  
OBJ: 9.1.1 Explain how to determine the charges of monatomic ions. BLM: comprehension

156. ANS: C  
OBJ: 9.1.1 Explain how to determine the charges of monatomic ions. BLM: application

157. ANS: C  
OBJ: 9.1.2 Explain how polyatomic ions differ from and are similar to monatomic ions. BLM: application

158. ANS: C  
OBJ: 9.1.1 Explain how to determine the charges of monatomic ions. 9.1.2 Explain how polyatomic ions differ from and are similar to monatomic ions. BLM: application

159. ANS: D  
OBJ: 9.1.2 Explain how polyatomic ions differ from and are similar to monatomic ions. BLM: application

160. ANS: A  
OBJ: 9.2.1 Apply the rules for naming and writing formulas for binary ionic compounds. BLM: comprehension

161. ANS: A  
OBJ: 9.2.1 Apply the rules for naming and writing formulas for binary ionic compounds. BLM: comprehension

162. ANS: B  
OBJ: 9.2.1 Apply the rules for naming and writing formulas for binary ionic compounds. 9.3.1 Apply the rules for naming and writing formulas for binary molecular compounds. BLM: application

163. ANS: D  
OBJ: 9.2.1 Apply the rules for naming and writing formulas for binary ionic compounds. BLM: application
OBJ: 9.2.1 Apply the rules for naming and writing formulas for binary ionic compounds.
BLM: application

OBJ: 9.2.1 Apply the rules for naming and writing formulas for binary ionic compounds.
BLM: application

166. ANS: C PTS: 1 DIF: L2 REF: p. 276 p. 277
OBJ: 9.2.2 Apply the rules for naming and writing formulas for compounds with polyatomic ions.
BLM: application

OBJ: 9.2.2 Apply the rules for naming and writing formulas for compounds with polyatomic ions.
BLM: application

OBJ: 9.3.1 Apply the rules for naming and writing formulas for binary molecular compounds.
BLM: application

169. ANS: C PTS: 1 DIF: L2 REF: p. 280
OBJ: 9.3.1 Apply the rules for naming and writing formulas for binary molecular compounds.
BLM: comprehension

170. ANS: B PTS: 1 DIF: L2 REF: p. 280 p. 281
OBJ: 9.3.1 Apply the rules for naming and writing formulas for binary molecular compounds.
BLM: application

171. ANS: D PTS: 1 DIF: L2 REF: p. 280
OBJ: 9.3.1 Apply the rules for naming and writing formulas for binary molecular compounds.
BLM: analysis

172. ANS: C PTS: 1 DIF: L2 REF: p. 286 p. 287
OBJ: 9.4.1 Determine the name and formula of an acid.
BLM: application

173. ANS: B PTS: 1 DIF: L2 REF: p. 286 p. 287
OBJ: 9.4.1 Determine the name and formula of an acid.
BLM: application

174. ANS: D PTS: 1 DIF: L2 REF: p. 286 p. 287
OBJ: 9.4.1 Determine the name and formula of an acid.
BLM: application

175. ANS: C PTS: 1 DIF: L1 REF: p. 287
OBJ: 9.4.2 Determine the name and formula of a base.
BLM: knowledge

176. ANS: D PTS: 1 DIF: L2 REF: p. 290
OBJ: 9.5.1 Explain how the law of definite proportions is consistent with Dalton’s atomic theory.
BLM: analysis

OBJ: 9.3.1 Apply the rules for naming and writing formulas for binary molecular compounds.
BLM: application

OBJ: 9.2.1 Apply the rules for naming and writing formulas for binary ionic compounds.
BLM: application

OBJ: 9.4.1 Determine the name and formula of an acid.
BLM: comprehension
OBJ: 9.2.2 Apply the rules for naming and writing formulas for compounds with polyatomic ions.  
9.5.2 List the general guidelines that can help you write the name and formula of a chemical compound.  
BLM: application

181. ANS: A  PTS: 1  DIF: L2  REF:  p. 268  
OBJ: 9.1.2 Explain how polyatomic ions differ from and are similar to monatomic ions.  
BLM: comprehension