Chapter 2 Atoms, Molecules, and Ions

1. What name is given to the concept that different samples of a given compound always contain the same elements in the same mass ratio?
   A) Ration Law
   B) Law of Equality
   C) First Law of Thermodynamics
   D) Law of Definite Proportions
   E) Second Law of Thermodynamics
   Ans: D Bloom's Taxonomy: 1 Difficulty: easy

2. The scientist who determined the magnitude of the electric charge of the electron was
   A) John Dalton.
   B) Robert Millikan.
   C) J. J. Thomson.
   D) Henry Moseley.
   E) J. Burdge.
   Ans: B Bloom's Taxonomy: 1 Difficulty: easy

3. When J. J. Thomson discovered the electron, what physical property of the electron did he measure?
   A) its charge, *e*
   B) its charge–to–mass ratio, *e*/*m*
   C) its temperature, *T*
   D) its mass, *m*
   E) its atomic number, *Z*
   Ans: B Bloom's Taxonomy: 1 Difficulty: easy

4. Which field of study made a large contribution toward understanding the composition of the atom?
   A) electricity
   B) radiation
   C) solution chemistry
   D) electrochemistry
   E) quantum mechanics
   Ans: B Bloom's Taxonomy: 1 Difficulty: easy

5. Which of the following is a type of radioactive radiation which has no charge and is unaffected by external electric or magnetic fields?
   A) α rays B) β rays C) γ rays D) δ rays E) ε rays
   Ans: C Bloom's Taxonomy: 1 Difficulty: easy

6. Which of the following is a type of radioactive radiation that consists of positively charged particles that are deflected away from a positively charged plate?
   A) α rays B) β rays C) γ rays D) δ rays E) ε rays
   Ans: A Bloom's Taxonomy: 1 Difficulty: easy

7. Which of the following is a type of radioactive radiation that consists of electrons and is deflected away from a negatively charged plate?
   A) α rays B) β rays C) γ rays D) δ rays E) ε rays
   Ans: B Bloom's Taxonomy: 1 Difficulty: easy

8. Which of these scientists developed the nuclear model of the atom?
   A) John Dalton
   B) Robert Millikan
   C) J. J. Thomson
   D) Henry Moseley
   E) Ernest Rutherford
   Ans: E Bloom's Taxonomy: 1 Difficulty: easy

9. Rutherford's experiment with alpha particle scattering by gold foil established that
   A) protons are not evenly distributed throughout an atom.
   B) electrons have a negative charge.
   C) electrons have a positive charge.
   D) atoms are made of protons, neutrons, and electrons.
   E) protons are 1840 times heavier than electrons.
   Ans: A Bloom's Taxonomy: 2 Difficulty: moderate

10. J. J. Thomson studied cathode ray particles (electrons) and was able to measure the mass/charge ratio. His results showed that
   A) the mass/charge ratio varied as the cathode material was changed.
   B) the charge was always a whole–number multiple of some minimum charge.
   C) matter included particles much smaller than the atom.
   D) atoms contained dense areas of positive charge.
   E) atoms are largely empty space.
   Ans: B Bloom's Taxonomy: 2 Difficulty: moderate

11. Who is credited with measuring the mass/charge ratio of the electron?
   A) Dalton B) Chadwick C) Thomson D) Millikan E) Rutherford
   Ans: C Bloom's Taxonomy: 1 Difficulty: easy

12. Who is credited with first measuring the charge of the electron?
   A) Dalton B) Gay–Lussac C) Thomson D) Millikan E) Rutherford
   Ans: D Bloom's Taxonomy: 1 Difficulty: easy

13. Millikan's oil–drop experiment
   A) established the charge on an electron.
   B) showed that all oil drops carried the same charge.
   C) provided support for the nuclear model of the atom.
   D) suggested that some oil drops carried fractional numbers of electrons.
   E) suggested the presence of a neutral particle in the atom.
   Ans: A Bloom's Taxonomy: 2 Difficulty: moderate

14. Who is credited with discovering the atomic nucleus?
   A) Dalton B) Gay–Lussac C) Thomson D) Chadwick E) Rutherford
   Ans: E Bloom's Taxonomy: 1 Difficulty: easy

15. Rutherford bombarded gold foil with alpha (α) particles and found that a small percentage of the particles were deflected. Which of the following was not accounted for by the model he proposed for the structure of atoms?
    A) the small size of the nucleus
    B) the charge on the nucleus
    C) the total mass of the atom
    D) the existence of protons
    E) the presence of electrons outside the nucleus
    Ans: C Bloom's Taxonomy: 2 Difficulty: moderate

16. Which one of the following statements about atoms and subatomic particles is correct?
    A) Rutherford discovered the atomic nucleus by bombarding gold foil with electrons.
    B) The proton and the neutron have identical masses.
    C) The neutron's mass is equal to that of a proton plus an electron.
    D) A neutral atom contains equal numbers of protons and electrons.
    E) An atomic nucleus contains equal numbers of protons and neutrons.
    Ans: D Bloom's Taxonomy: 2 Difficulty: difficult

17. Who discovered the subatomic particle having a neutral charge the neutron?
    A) Millikan B) Dalton C) Chadwick D) Rutherford E) Thomson
    Ans: C Bloom's Taxonomy: 1 Difficulty: easy

18. What is the name used to represent the number of protons in the nucleus of each atom of an element and is equal to the number of electrons outside the nucleus?
    A) isotope number
    B) mass number
    C) mass–to–charge ratio
    D) atomic number
    E) atomic mass units
    Ans: D Bloom's Taxonomy: 1 Difficulty: easy

19. What is the name used to represent the total number of neutrons and protons in the nucleus of each atom of an element?
    A) isotope number
    B) mass number
    C) mass–to–charge ratio
    D) atomic number
    E) atomic mass units
    Ans: B Bloom's Taxonomy: 1 Difficulty: easy

20. Bromine is the only nonmetal that is a liquid at room temperature. Consider the isotope bromine–81, $^{81}_{35}\mathrm{Br}$. Select the combination which lists the correct atomic number, neutron number, and mass number, respectively.
    A) 35, 46, 81
    B) 35, 81, 46
    C) 81, 46, 35
    D) 46, 81, 35
    E) 35, 81, 116
    Ans: A Bloom's Taxonomy: 3 Difficulty: moderate

21. Atoms X, Y, Z, and R have the following nuclear compositions:

$^{410}_{186}X$ $^{410}_{183}Y$ $^{412}_{186}Z$ $^{412}_{185}R$

Which two are isotopes?
A) X & Y B) X & R C) Y & R D) Z & R E) X & Z
Ans: E Bloom's Taxonomy: 3 Difficulty: moderate

22. Atoms of the same element with different mass numbers are called
A) ions.
B) neutrons.
C) allotropes.
D) chemical families.
E) isotopes.
Ans: E Bloom's Taxonomy: 1 Difficulty: easy

23. How many neutrons are there in an atom of lead whose mass number is 208?
A) 82 B) 126 C) 208 D) 290 E) none of the above
Ans: B Bloom's Taxonomy: 3 Difficulty: moderate

24. An atom of the isotope sulfur–31 consists of how many protons, neutrons, and electrons?
A) 15 protons, 16 neutrons, 15 electrons
B) 16 protons, 15 neutrons, 16 electrons
C) 16 protons, 31 neutrons, 16 electrons
D) 32 protons, 31 neutrons, 32 electrons
E) 16 protons, 16 neutrons, 15 electrons
Ans: B Bloom's Taxonomy: 3 Difficulty: moderate

25. Give the number of protons, electrons, and neutrons in one atom of chlorine–37.
A) 37 protons, 37 electrons, 17 neutrons
B) 17 protons, 17 electrons, 37 neutrons
C) 17 protons, 17 electrons, 20 neutrons
D) 37 protons, 17 electrons, 20 neutrons
E) 17 protons, 37 electrons, 17 neutrons
Ans: C Bloom's Taxonomy: 3 Difficulty: moderate

26. Two isotopes of an element differ only in their
A) symbol.
B) atomic number.
C) atomic mass.
D) number of protons.
E) number of electrons.
Ans: C Bloom's Taxonomy: 1 Difficulty: easy

27. A magnesium ion, Mg^{2+}, has
A) 12 protons and 13 electrons.
B) 24 protons and 26 electrons.
C) 12 protons and 10 electrons.
D) 24 protons and 22 electrons.
E) 12 protons and 14 electrons.
Ans: C Bloom's Taxonomy: 3 Difficulty: difficult

28. An aluminum ion, Al^{3+}, has
    A) 13 protons and 13 electrons.
    B) 27 protons and 24 electrons.
    C) 16 protons and 13 electrons.
    D) 13 protons and 10 electrons.
    E) 10 protons and 13 electrons.
    Ans: D Bloom's Taxonomy: 3 Difficulty: difficult

29. An oxide ion, O^{2-}, has
    A) 8 protons and 10 electrons.
    B) 10 protons and 8 electrons.
    C) 8 protons and 9 electrons.
    D) 8 protons and 7 electrons.
    E) 10 protons and 7 electrons.
    Ans: A Bloom's Taxonomy: 3 Difficulty: difficult

30. A sulfide ion, S^{2-}, has
    A) 16 protons and 16 electrons.
    B) 32 protons and 16 electrons.
    C) 16 protons and 14 electrons.
    D) 16 protons and 18 electrons.
    E) 32 protons and 18 electrons.
    Ans: D Bloom's Taxonomy: 3 Difficulty: difficult

31. How many protons and electrons are present in one Br^- ion?
    A) 35 protons, 35 electrons
    B) 80 protons, 81 electrons
    C) 35 protons, 34 electrons
    D) 35 protons, 36 electrons
    E) 80 protons, 34 electrons
    Ans: D Bloom's Taxonomy: 3 Difficulty: difficult

32. The elements in a column of the periodic table are known as
    A) metalloids.
    B) a period.
    C) noble gases.
    D) a group.
    E) nonmetals.
    Ans: D Bloom's Taxonomy: 1 Difficulty: easy

33. Which of these materials are usually poor conductors of heat and electricity?
    A) metals
    B) metalloids
    C) nonmetals
    D) alkaline earth metals
    E) alkali metals
    Ans: C Bloom's Taxonomy: 1 Difficulty: easy

34. Which of these elements is most likely to be a good conductor of electricity?
    A) N B) S C) He D) Cl E) Fe
    Ans: E Bloom's Taxonomy: 2 Difficulty: difficult

35. Which of the following elements are the least reactive?
    A) alkali metals
    B) noble gases
    C) halogens
    D) alkaline earth metals
    E) metalloids
    Ans: B Bloom's Taxonomy: 1 Difficulty: easy

36. Which of the following is a nonmetal?
    A) lithium, Li, $Z = 3$
    B) bromine, Br, $Z = 35$
    C) mercury, Hg, $Z = 80$
    D) bismuth, Bi, $Z = 83$
    E) sodium, Na, $Z = 11$
    Ans: B Bloom's Taxonomy: 2 Difficulty: moderate

37. Which of the following is a metal?
    A) nitrogen, N, $Z = 7$
    B) phosphorus, P, $Z = 15$
    C) arsenic, As, $Z = 33$
    D) thallium, Tl, $Z = 81$
    E) silicon, Si, $Z = 14$
    Ans: D Bloom's Taxonomy: 2 Difficulty: moderate

38. Which of the following is a metalloid?
    A) carbon, C, $Z = 6$
    B) sulfur, S, $Z = 16$
    C) germanium, Ge, $Z = 32$
    D) iridium, Ir, $Z = 77$
    E) bromine, Br, $Z = 35$
    Ans: C Bloom's Taxonomy: 2 Difficulty: moderate

39. A row of the periodic table is called a
    A) group. B) period. C) isotopic mixture. D) family. E) subshell.
    Ans: B Bloom's Taxonomy: 1 Difficulty: easy

40. Which of these elements is chemically similar to magnesium?
    A) sulfur B) calcium C) iron D) nickel E) potassium
    Ans: B Bloom's Taxonomy: 2 Difficulty: difficult

41. Which of these elements is chemically similar to oxygen?
    A) sulfur B) calcium C) iron D) nickel E) potassium
    Ans: A Bloom's Taxonomy: 2 Difficulty: difficult

42. Which of these elements is chemically similar to potassium?
    A) calcium B) arsenic C) phosphorus D) cerium E) cesium
    Ans: E Bloom's Taxonomy: 2 Difficulty: difficult

43. Silicon, which makes up approximately 25% of the Earth's crust by mass, is used widely in the modern electronics industry. It has three naturally occurring isotopes, ^{28}Si, ^{29}Si, and ^{30}Si. Calculate the atomic mass of silicon.

Isotope	Isotopic Mass (amu)	Abundance %
^{28}Si	27.976927	92.23
^{29}Si	28.976495	4.67
^{30}Si	29.973770	3.10

A) 29.2252 amu
B) 28.9757 amu
C) 28.7260 amu
D) 28.0855 amu
E) 27.9801 amu

Ans: D Bloom's Taxonomy: 3 Difficulty: difficult

44. Lithium forms compounds which are used in dry cells and storage batteries and in high–temperature lubricants. It has two naturally occurring isotopes, ^{6}Li (isotopic mass = 6.015121 amu) and ^{7}Li (isotopic mass = 7.016003 amu). Lithium has an atomic mass of 6.9409 amu. What is the percent abundance of lithium–6?
A) 92.50% B) 86.66% C) 46.16% D) 7.503% E) 6.080%
Ans: D Bloom's Taxonomy: 3 Difficulty: difficult

45. What is the name used to define a mass which is exactly equal to 1/12 the mass of one carbon–12 atom?
A) isotope number
B) mass number
C) mass–to–charge ratio
D) atomic number
E) atomic mass units

Ans: E Bloom's Taxonomy: 1 Difficulty: easy

46. Which of the following cannot exist as a homonuclear diatomic molecule?
A) hydrogen B) phosphorus C) fluorine D) nitrogen E) oxygen
Ans: B Bloom's Taxonomy: 2 Difficulty: difficult

47. Which is the correct definition of a diatomic molecule?
A) A molecule which contains two or more of the same atoms.
B) A molecule which contains two or more different atoms.
C) A molecule which contains two identical atoms.
D) A molecule which contains two different atoms.
E) c and d

Ans: E Bloom's Taxonomy: 1 Difficulty: easy

48. Which is the correct definition of a polyatomic molecule?
    A) A molecule which contains two or more of the same atoms.
    B) A molecule which contains two or more different atoms.
    C) a and b
    D) A molecule which contains two identical atoms.
    E) A molecule which contains two different atoms.
    Ans: D Bloom's Taxonomy: 1 Difficulty: easy

49. Which is the correct definition of a heteronuclear diatomic molecule?
    A) A molecule which contains two or more of the same atoms.
    B) A molecule which contains two or more different atoms.
    C) a and b
    D) A molecule which contains two identical atoms.
    E) A molecule which contains two different atoms.
    Ans: E Bloom's Taxonomy: 1 Difficulty: easy

50. What represents the exact number of atoms of each element in a molecule?
    A) chemical formula
    B) compound
    C) constitutional formula
    D) molecular formula
    E) atomic formula
    Ans: D Bloom's Taxonomy: 1 Difficulty: easy

51. Which of the following are allotropes?
    A) diamond and graphite
    B) hydrogen and deuterium
    C) bromine and chlorine
    D) hydrogen and oxygen
    E) none of the above
    Ans: A Bloom's Taxonomy: 1 Difficulty: moderate

52. Which, if any, of the following elements do not occur in the major classes of organic compounds?
    A) H
    B) C
    C) N
    D) O
    E) All the above elements occur in the major classes of organic compounds.
    Ans: E Bloom's Taxonomy: 2 Difficulty: moderate

53. What name is given to a class of compounds that generally do not contain carbon?
    A) acarbonic compounds
    B) carbonic compounds
    C) organic compounds
    D) inorganic compounds
    E) aldehyde compounds
    Ans: D Bloom's Taxonomy: 1 Difficulty: easy

54. Which of the following is the empirical formula for hexane, C_6H_{14}?
A) $C_{12}H_{28}$ B) C_6H_{14} C) C_3H_7 D) $CH_{2.3}$ E) $C_{0.43}H$
Ans: C Bloom's Taxonomy: 3 Difficulty: moderate

55. Which of the following is a molecular formula for CH?
A) C_2H_6
B) C_3H_9
C) C_4H_{10}
D) C_6H_6
E) None of the answers are correct.
Ans: D Bloom's Taxonomy: 3 Difficulty: moderate

56. An anion is defined as
A) a charged atom or group of atoms with a net negative charge.
B) a stable atom.
C) a group of stable atoms.
D) an atom or group of atoms with a net positive charge.
E) neutral.
Ans: A Bloom's Taxonomy: 1 Difficulty: easy

57. Which one of these species is an ion?
A) B^{3+} B) NaCl C) He D) ^{14}C E) none of the above
Ans: A Bloom's Taxonomy: 2 Difficulty: moderate

58. Which of these pairs of elements would be most likely to form an ionic compound?
A) P and Br B) Cu and K C) C and O D) O and Zn E) Al and Rb
Ans: D Bloom's Taxonomy: 2 Difficulty: difficult

59. What is the formula for the ionic compound formed by calcium ions and nitrate ions?
A) Ca_3N_2 B) $Ca(NO_3)_2$ C) Ca_2NO_3 D) Ca_2NO_2 E) $CaNO_3$
Ans: B Bloom's Taxonomy: 3 Difficulty: moderate

60. What is the formula for the ionic compound formed by calcium and selenium?
A) CaSe B) Ca_2Se C) $CaSe_2$ D) Ca_3Se E) $CaSe_3$
Ans: A Bloom's Taxonomy: 3 Difficulty: moderate

61. Which one of the following formulas of ionic compounds is the least likely to be correct?
A) NH_4Cl B) $Ba(OH)_2$ C) Na_2SO_4 D) Ca_2NO_3 E) $Cu(CN)_2$
Ans: D Bloom's Taxonomy: 4 Difficulty: difficult

62. Which is the correct formula for copper (II) phosphate?
A) Cu_2PO_4 B) $Cu_3(PO_4)_2$ C) Cu_2PO_3 D) $Cu(PO_4)_2$ E) $Cu(PO_3)_2$
Ans: B Bloom's Taxonomy: 3 Difficulty: moderate

63. What is the name of PCl_3?
    A) phosphorus chloride
    B) phosphoric chloride
    C) phosphorus trichlorate
    D) trichlorophosphide
    E) phosphorus trichloride
    Ans: E Bloom's Taxonomy: 3 Difficulty: moderate

64. The compound, P_4S_{10}, is used in the manufacture of safety matches. What is its name?
    A) phosphorus sulfide
    B) phosphoric sulfide
    C) phosphorus decasulfide
    D) tetraphosphorus decasulfide
    E) phosphorus sulfite
    Ans: D Bloom's Taxonomy: 3 Difficulty: moderate

65. Diiodine pentaoxide is used as an oxidizing agent that converts carbon monoxide to carbon dioxide. What is its chemical formula?
    A) I_2O_5 B) IO_5 C) $2IO_5$ D) I_5O_2 E) $(IO_5)_2$
    Ans: A Bloom's Taxonomy: 3 Difficulty: moderate

66. What is the name of P_4Se_3?
    A) phosphorus selenide
    B) phosphorus triselenide
    C) tetraphosphorus selenide
    D) phosphoric selenide
    E) tetraphosphorus triselenide
    Ans: E Bloom's Taxonomy: 3 Difficulty: moderate

67. What is the name of ClO^-?
    A) hypochlorite B) chlorate C) chlorite D) perchlorate E) perchlorite
    Ans: A Bloom's Taxonomy: 3 Difficulty: moderate

68. What is the formula for the permanganate ion?
    A) MnO_2^- B) MnO_4^- C) MgO_4^{2-} D) $Mn_2O_7^-$ E) MgO_2^{2-}
    Ans: B Bloom's Taxonomy: 3 Difficulty: moderate

69. Tetrasulfur dinitride decomposes explosively when heated. What is its formula?
    A) S_2N_4 B) S_4N_2 C) $4SN_2$ D) S_4N E) S_2N
    Ans: B Bloom's Taxonomy: 3 Difficulty: moderate

70. The chemical name for ClO^{3-} is "chlorate ion." What is the common name for $HClO_3$?
    A) hydrochloric acid
    B) chloroform
    C) hydrogen trioxychloride
    D) chlorous acid
    E) chloric acid
    Ans: E Bloom's Taxonomy: 2 Difficulty: moderate

71. The formula for magnesium sulfate is
    A) MnS. B) MgS. C) $MnSO_3$. D) $MgSO_4$. E) $MnSO_4$.
    Ans: D Bloom's Taxonomy: 3 Difficulty: moderate

72. The formula for sodium sulfide is
A) NaS. B) K_2S. C) NaS_2. D) Na_2S. E) SeS.
Ans: D Bloom's Taxonomy: 3 Difficulty: moderate

73. The chemical formula for iron (II) nitrate is
A) $Fe_2(NO_3)_3$. B) $Ir(NO_2)_2$. C) Fe_2N_3. D) $Fe(NO_3)_2$. E) $Fe(NO_2)_2$.
Ans: D Bloom's Taxonomy: 3 Difficulty: moderate

74. What is the formula for lead (II) oxide?
A) PbO B) PbO_2 C) Pb_2O D) PbO_4 E) Pb_2O_3
Ans: A Bloom's Taxonomy: 3 Difficulty: moderate

75. Potassium permanganate is a strong oxidizer that reacts explosively with easily oxidized materials. What is its formula?
A) $KMnO_3$ B) $KMnO_4$ C) K_2MnO_4 D) $K(MnO_4)_2$ E) $K_2Mn_2O_7$
Ans: B Bloom's Taxonomy: 3 Difficulty: moderate

76. Ferric oxide is used as a pigment in metal polishing. Which of the following is its formula?
A) FeO B) Fe_2O C) FeO_3 D) Fe_2O_5 E) Fe_2O_3
Ans: E Bloom's Taxonomy: 3 Difficulty: moderate

77. What is the name of $Mn(CO_3)_2$?
A) manganese carbide
B) magnesium (IV) carbonate
C) manganese (II) carbonate
D) magnesium (II) carbonate
E) manganese (IV) carbonate
Ans: E Bloom's Taxonomy: 3 Difficulty: moderate

78. Iron (III) chloride hexahydrate is used as a coagulant for sewage and industrial wastes. What is its formula?
A) $Fe(Cl\cdot 6H_2O)_3$
B) $Fe_3Cl\cdot 6H_2O$
C) $FeCl_3(H_2O)_6$
D) $Fe_3Cl(H_2O)_6$
E) $FeCl_3\cdot 6H_2O$
Ans: E Bloom's Taxonomy: 3 Difficulty: difficult

79. Which of the following is the oxoanion of bromine called the bromate ion?
A) BrO_3^- B) BrO_3^{2-} C) BrO_4^{2-} D) BrO_2^- E) BrO^-
Ans: A Bloom's Taxonomy: 3 Difficulty: difficult

80. True or False: The mass of a neutron is equal to the mass of a proton plus the mass of an electron.
Ans: False Bloom's Taxonomy: 1 Difficulty: easy

81. True or False: Almost all the mass of an atom is concentrated in the nucleus.
Ans: True Bloom's Taxonomy: 1 Difficulty: easy

82. True or False: When a beam of alpha particles passes between two electrically charged plates, the beam is deflected toward the positive plate.
Ans: False Bloom's Taxonomy: 2 Difficulty: moderate

83. True or False: J. J. Thomson suggested the name "radioactivity" to describe the spontaneous emission of particles and/or radiation.
Ans: False Bloom's Taxonomy: 1 Difficulty: moderate

84. True or False: All neutral atoms of tin have 50 protons and 50 electrons.
Ans: True Bloom's Taxonomy: 2 Difficulty: moderate

85. True or False: Copper (Cu) is a transition metal.
Ans: True Bloom's Taxonomy: 2 Difficulty: moderate

86. True or False: Lead (Pb) is a main–group element.
Ans: True Bloom's Taxonomy: 2 Difficulty: moderate

87. True or False: When an alkali metal combines with a nonmetal, a covalent bond is normally formed.
Ans: False Bloom's Taxonomy: 2 Difficulty: moderate

88. True or False: An allotrope is a mixture of forms of the same compound that exist in the same physical state under the same conditions of temperature and pressure.
Ans: False Bloom's Taxonomy: 1 Difficulty: easy

89. True or False: The empirical formula of C_6H_6 is CH.
Ans: True Bloom's Taxonomy: 3 Difficulty: difficult

90. True or False: An ionizable hydrogen atom is a hydrogen atom that separates from the molecule when the molecule is dissolved in a solution and becomes a hydrogen ion, H^+.
Ans: True Bloom's Taxonomy: 1 Difficulty: easy

91. True or False: Ionic compounds may carry a net positive or negative charge.
Ans: False Bloom's Taxonomy: 2 Difficulty: moderate

92. What is the law that describes different samples of a given compound that always contain the same elements in the same mass ratio?
Ans: Law of Definite Proportions
Bloom's Taxonomy: 1 Difficulty: easy

93. What is the Law of Conservation of Mass?
Ans: Matter can be neither created nor destroyed.
Bloom's Taxonomy: 1 Difficulty: easy

94. What are the three types of radiation produced by the decay of substances like uranium?
Ans: alpha, beta, and gamma radiation
Bloom's Taxonomy: 1 Difficulty: moderate

95. How many neutrons are in ^{13}C?
Ans: 7
Bloom's Taxonomy: 3 Difficulty: moderate

96. What is the name given for the elements in Group 1A in the periodic table?
Ans: alkali metals
Bloom's Taxonomy: 1 Difficulty: easy

97. What is the name given for the elements in Group 7A in the periodic table?
Ans: halogens
Bloom's Taxonomy: 1 Difficulty: easy

98. Which group is given the name chalcogens?
Ans: Group 6A
Bloom's Taxonomy: 1 Difficulty: easy

99. What name is given to the simplest organic compounds which only contain carbons and hydrogens?
Ans: hydrocarbons
Bloom's Taxonomy: 1 Difficulty: easy

100. What is the name of Cu_2O?
Ans: copper (I) oxide
Bloom's Taxonomy: 3 Difficulty: moderate

101. What is the formula for sodium dichromate?
Ans: $Na_2Cr_2O_7$
Bloom's Taxonomy: 3 Difficulty: difficult

102. Define ion.
Ans: An ion is an atom or group of atoms that has a net positive or negative charge.
Bloom's Taxonomy: 1 Difficulty: easy

103. _____ is the emission and transmission of energy through space in the form of waves.
Ans: Radiation
Bloom's Taxonomy: 1 Difficulty: easy

104. _____ is the negatively charged plate connected to a high–voltage source.
Ans: Cathode
Bloom's Taxonomy: 1 Difficulty: easy

105. _____ coined the term radioactivity to describe the spontaneous emission of particles and/or radiation.
Ans: Marie Curie
Bloom's Taxonomy: 1 Difficulty: easy

106. _____ are electrons that are deflected away from negatively charged plates.
Ans: β particles
Bloom's Taxonomy: 1 Difficulty: easy

107. Fill in the blank spaces and write out all the symbols in the left hand column in full, in the form ${}^{A}_{Z}X$ (i.e., include the appropriate values of *Z* and *A* as well as the correct symbol X).

Symbol	# protons	# neutrons	# electrons
…	17	18	…
${}^{197}_{79}Au$	…	118	…
…	…	20	20

Ans:

${}^{35}_{17}Cl$	17	18	17
${}^{197}_{79}Au$	79	118	79
${}^{40}_{20}Ca$	20	20	20

Bloom's Taxonomy: 3 Difficulty: difficult

108. _____ are atoms that have the same atomic number (*Z*) but different mass numbers (*A*).
Ans: Isotopes
Bloom's Taxonomy: 1 Difficulty: easy

109. _____ have properties that are intermediate between those of metals and nonmetals.
Ans: Metalloids
Bloom's Taxonomy: 1 Difficulty: easy

110. _____ are the name given for the elements in Group VIIIA.
Ans: Noble gases
Bloom's Taxonomy: 1 Difficulty: easy

111. _____ is defined as a mass exactly equal to one–twelfth the mass of one carbon–12 atom.
Ans: One atomic mass unit
Bloom's Taxonomy: 1 Difficulty: easy

112. _____ compounds consist of two different elements.
Ans: Binary
Bloom's Taxonomy: 1 Difficulty: easy

113. _____ are one of two or more distinct forms of an element.
Ans: Allotropes
Bloom's Taxonomy: 1 Difficulty: easy

114. When one of the hydrogen atoms in a molecule is replaced by a group of atoms, this group of atoms is known as a _____.
Ans: functional group
Bloom's Taxonomy: 1 Difficulty: moderate

115. Name the three important "laws" that were accounted for by Dalton's atomic theory.
Ans: Laws of Conservation of Mass; Definite Composition; Multiple Proportions
Bloom's Taxonomy: 1 Difficulty: easy

116. Dalton's atomic theory has required some modifications in the light of subsequent discoveries. For any three appropriate postulates of Dalton's atomic theory: state the postulate in its original form and in one sentence, describe why the postulate has needed modification.
Ans: Matter consists of atoms which are indivisible, cannot be created or destroyed. But, atoms are divisible, as the existence of subatomic particles shows.
Atoms of one element cannot be converted into atoms of another element. They can be converted in various nuclear reactions, including radioactive decay. Atoms of an element are identical in mass and other properties. Isotopes of an element differ in their masses and other properties.
Bloom's Taxonomy: 5 Difficulty: difficult

117. In the early 1900s, Ernest Rutherford performed an experiment with gold foil, targets and alpha particles to probe the structure of the atoms. He observed that most of these alpha particles penetrated the foil undeflected. Realizing that atoms are electrically neutral (that is, they have equal numbers of protons and electrons) and that the mass of a proton is significantly greater than the mass of an electron, use Rutherford's data to propose a structural model of an atom
Ans: (Answers will vary.) Atoms are mostly empty space. The mass is concentrated mostly at the center of the atom.
Bloom's Taxonomy: 5 Difficulty: difficult

118. Describe the contributions of Marie Curie.
Ans: (Note that answers will vary.) Marie Curie discovered two new elements, and is one of three people to win two Nobel Prizes. She also suggested the term "radioactivity" to describe the spontaneous emission of particles and/or radiation.
Bloom's Taxonomy: 5 Difficulty: moderate

119. State the two important experimental results (and the names of the responsible scientists) which enabled the mass of the electron to be determined.
Ans: Thomson measured *m*/*e*, the mass–to–charge ratio. Millikan measured *e*, the charge. Thus, the mass *m* could be calculated.
Bloom's Taxonomy: 1 Difficulty: moderate

120. The table below describes four atoms.

	Atom A	Atom B	Atom C	Atom D
Number of protons	79	80	80	79
Number of neutrons	118	120	118	120
Number of electrons	79	80	80	79

Which atoms represent the same element?
Ans: Atoms A and D represent the same element. Atoms B and C represent the same element.
Bloom's Taxonomy: 3 Difficulty: difficult

121. Determine the average atomic mass of boron is the natural abundance of ^{10}B weighing exactly 10.0129 amu is 19.9% and the natural abundance of ^{11}B weighing exactly 11.0093 amu is 80.1%? Show all your work
Ans: (10.0129)(0.199) + (11.0093)(0.801) = 10.81 amu
Bloom's Taxonomy: 3 Difficulty: difficult

122. Describe the difference between an empirical formula and a molecular formula.
Ans: An empirical formula is the simplest chemical formula that has the smallest possible whole–number ratio of atoms in the formula and a molecular formula is the true formula of a molecule which is a whole–number multiple of its empirical formula.
Bloom's Taxonomy: 2 Difficulty: moderate

123. Explain what is meant by an ionizable hydrogen atom.
Ans: It is one that separates from the molecule upon dissolving and becomes a hydrogen ion, H^+.
Bloom's Taxonomy: 1 Difficulty: easy

124. Describe what is meant by the term functional group in organic chemistry.
Ans: A functional group is a group of atoms that have replaced one of the hydrogen atoms in an organic compound.
Bloom's Taxonomy: 1 Difficulty: easy