CHAPTER 3

1. Which combination of individual and contribution is not correct?
   a. Antoine Lavoisier - clarified confusion over cause of burning
   b. John Dalton - proposed atomic theory
   c. Marie Curie - discovered radium and polonium
   d. Robert Millikan - discovered the neutron

   ANS: d

2. John Dalton did his research work in which of the following countries?
   a. France
   b. Greece
   c. Russia
   d. England

   ANS: d

3. In a neutral atom there is an equal number of
   a. protons and electrons
   b. neutrons and protons
   c. electrons and neutrons
   d. protons, electrons, and neutrons

   ANS: a

4. Which radiation type has no detectable charge?
   a. alpha
   b. beta
   c. gamma
   d. both alpha and beta

   ANS: c

5. Which radiation type was shown to be identical with the electron?
   a. alpha
   b. beta
   c. gamma
   d. none are identical with the electron

   ANS: b
6. Rutherford's foil experiment provided evidence for what atomic feature?
   a. nucleus
   b. electron
   c. proton
   d. neutron

   ANS: a

7. Which sub-atomic particle has the incorrect charge indicated?
   a. proton - positive
   b. electron - negative
   c. neutron - neutral
   d. nucleus - neutral

   ANS: d

8. In the atom represented by the symbol $^{23}\text{Na}$, there are
   a. 11 protons, 11 electrons, 23 neutrons
   b. 12 protons, 12 electrons, 23 neutrons
   c. 11 protons, 11 electrons, 12 neutrons
   d. 12 protons, 12 electrons, 34 neutrons

   ANS: c

9. What is the symbol for a neutral atom with 7 protons, 7 electrons, and 8 neutrons?
   a. Si
   b. P
   c. Ne
   d. N

   ANS: d

10. Which of the following is not included with a periodic table entry?
    a. atomic number
    b. mass number
    c. atomic weight
    d. symbol

    ANS: b
11. What element is used to define the atomic mass unit scale?
   a. hydrogen
   b. oxygen
   c. neon
   d. carbon

   ANS: d

12. What is the main color of visible light emitted by neon?
   a. yellow
   b. orange-red
   c. blue
   d. green

   ANS: b

13. Sunburn and some forms of skin cancer are caused by what kind of light?
   a. infrared, IR
   b. gamma, g
   c. microwave
   d. ultraviolet, UV

   ANS: d

14. Which statement is true about the speed of photons and light waves?
   a. red light is slower than blue light
   b. each color travels at a different speed
   c. all travel at the same speed
   d. the longer the wavelength, the lower the speed

   ANS: c

15. Which of the following has the longest wavelength?
   a. radio waves
   b. X-rays
   c. visible light
   d. ultraviolet

   ANS: a
16. Which relationship is correct?
   a. lower wavelength, small energy  
   b. lower frequency, lower wavelength  
   c. higher wavelength, higher frequency  
   d. higher frequency, larger energy  

   ANS: d

17. The third energy level can hold a maximum of how many electrons?
   a. 0  
   b. 3  
   c. 9  
   d. 18  

   ANS: d

18. What is the number of valence electrons in phosphorus (P) with an electron configuration of 2-8-5?
   a. 13  
   b. 8  
   c. 5  
   d. 15  

   ANS: c

19. Which electron configuration is inconsistent with the Bohr model?
   a. 2-8-1  
   b. 2-6  
   c. 2-8-9  
   d. 2-8-8  

   ANS: c

20. Which color of light carries the most energy per photon?
   a. blue  
   b. green  
   c. orange  
   d. red  

   ANS: a
21. The term *atom* was first used by
   a. Dalton
   b. Rutherford
   c. Democritus
   d. Lavoisier

   ANS: c

22. Who was the first person to propose a consistent modern atomic theory?
   a. Democritus
   b. Lavoisier
   c. Proust
   d. Dalton

   ANS: d

23. Carbon dioxide (CO$_2$) always has the same formula. What principle does this illustrate?
   a. the law of electric neutrality
   b. the law of conservation of matter
   c. the law of definite proportions
   d. no particular law

   ANS: c

24. Which statement was not part of Dalton's atomic theory?
   a. matter is composed of indestructible particles called atoms
   b. all atoms of a given element are alike
   c. elements and compounds are composed of definite arrays of atoms
   d. some atoms may emit nuclear radiation

   ANS: d

25. Which wavelength of visible light is red?
   a. 400 nm
   b. 500 nm
   c. 700 nm
   d. 300 nm

   ANS: c
26. Who proposed the law of definite proportions?
   a. Thomson
   b. Rutherford
   c. Dalton
   d. Proust
   ANS: d

27. How will a stream of electrons behave in an electric field?
   a. be unchanged
   b. be stopped
   c. be deflected toward the positive pole
   d. be deflected toward the negative pole
   ANS: c

28. The STM, scanning tunneling microscope, shows
   a. the outer boundary surface of the electrons in an atom
   b. number of excited electrons in an atom
   c. the charge on the nucleus
   d. the mass of the nucleus
   ANS: a

29. Which of the following ground state configurations matches represents an atom with 3 valence electrons?
   a. 2-8-3
   b. 2-1
   c. 2-3-5
   d. 2-8-8
   ANS: a

30. What metal was used as the foil in Rutherford's famous scattering experiment?
   a. tin
   b. aluminum
   c. gold
   d. silver
   ANS: c
31. The name given to the number of protons in an atom's nucleus is
   a. atomic number
   b. family number
   c. electron number
   d. mass number

   ANS: a

32. Two atoms which have the same atomic number but different mass numbers are called
   a. sisters
   b. neutrinos
   c. allotropes
   d. isotopes

   ANS: d

33. What name is given to the sum of neutrons and protons in an atom's nucleus?
   a. atomic number
   b. mass number
   c. isotope number
   d. atomic mole mass

   ANS: b

34. An electric field can deflect a beam of beta, alpha and gamma rays. Which ray will be deflected the least?
   a. alpha
   b. beta
   c. gamma
   d. all are deflected by the same amount

   ANS: c

35. What experimental evidence served as a basis of Bohr's atomic theory?
   a. magnetic measurements
   b. behavior of atoms at low temperatures
   c. atomic mass
   d. atomic spectra

   ANS: d
36. Which is the ground state of a hydrogen atom?
   a. three electrons in the n = 1 level
   b. one electron in the n = 2 level
   c. one electron in the n = 1 level
   d. one electron in the n = 1 level and one electron in the n = 2 level

   ANS: c

37. Which of the following ground state configuration matches Ar, argon?
   a. 2-8-1
   b. 2-2-6-2-6
   c. 2-2-6-8
   d. 2-8-8

   ANS: d

38. The modern periodic table is based on arranging elements in the order of their
   a. atomic weight
   b. atomic number
   c. mass number
   d. isotope number

   ANS: b

39. What elements make up the A group of elements?
   a. representative or main-group
   b. transition
   c. lanthanide
   d. actinide

   ANS: a

40. The majority of the elements are
   a. gases
   b. nonmetals
   c. radioactive
   d. metals

   ANS: d
41. Which element is found in Group IIA - in Period 4?
   a. magnesium, Mg
   b. zinc, Zn
   c. calcium, Ca
   d. potassium, K

   ANS: c

42. Which is not a property of nonmetals?
   a. malleable
   b. insulator
   c. gain electrons to form negative ions
   d. poor conductor of electricity

   ANS: a

43. Which element is a noble gas?
   a. Ni
   b. Ne
   c. Si
   d. B

   ANS: b

44. Which sequence lists a nonmetal, metalloid, and a transition metal, respectively?
   a. Al, As, Ag
   b. Co, Pb, P
   c. O, Ge, Cs
   d. N, Si, Fe

   ANS: d

45. Which element would most likely have the Lewis dot symbol, :X:?
   a. oxygen
   b. nitrogen
   c. carbon
   d. fluorine

   ANS: c
46. How many valence electrons are in boron, B?
   a. 5
   b. 3
   c. 2
   d. 0

   ANS: b

47. Which is not true about metals?
   a. good conductors of heat
   b. form positive ions
   c. can be stretched or drawn into wires
   d. many are liquids

   ANS: d

48. In the following set, which atom is the smallest?
   a. Ar
   b. Mg
   c. Cl
   d. Si

   ANS: a

49. Which of the following halogens has the smallest atomic radius?
   a. iodine
   b. fluorine
   c. bromine
   d. chlorine

   ANS: b

50. What element (X) is a metal that forms +1 ions?
   a. sodium (Na)
   b. aluminum (Al)
   c. calcium (Ca)
   d. nitrogen (N)

   ANS: a
51. Which element is a metal?
   a. Cl
   b. Na
   c. Ar
   d. S

   ANS: b

52. Which element conducts electricity well?
   a. arsenic
   b. boron
   c. sulfur
   d. silver

   ANS: d

53. If the compound formed by radium and bromine has the formula RaBr2, what is the formula of the compound formed by strontium (Sr) and iodine (I)?
   a. SrI
   b. Sr2I
   c. SrI2
   d. no correlation between radium and strontium

   ANS: c

54. Sodium has chemical properties most like
   a. cesium, Cs
   b. magnesium, Mg
   c. chlorine, Cl
   d. mercury, Hg

   ANS: a

55. The reason for your answer in the previous question is that both cesium and sodium
   a. have about the same atomic weight
   b. have about the same atomic number
   c. are both metals
   d. are in the same group of the periodic table

   ANS: d
56. Who was the Russian who was a pioneer in the development of the periodic law?
   a. Meyerovick
   b. Mendeleev
   c. Dobereiner
   d. Newlands

   ANS: b

57. The periodic law of the elements states that the properties of the elements are a periodic function of
   a. atomic weights
   b. atomic numbers
   c. both atomic weights and atomic numbers
   d. neither atomic weights nor atomic numbers

   ANS: b

58. Which of the following is a transition element in the periodic table?
   a. sodium
   b. sulfur
   c. boron
   d. chromium

   ANS: d

59. A noble gas is
   a. Al
   b. Ar
   c. H
   d. O

   ANS: b

60. Which of the following is an atom in Group IVA?
   a. C
   b. Cu
   c. Cs
   d. Cl

   ANS: a
61. Elements that conduct heat and electricity well are
   a. nonmetals
   b. noble gases
   c. metals
   d. metalloids

   ANS: c

62. Which group of elements is all alkaline earths?
   a. Mg, Cl, Na, As
   b. Ca, Mg, Ba, Ra
   c. Ba, Al, Na, As
   d. Na, K, Li, Rb

   ANS: b

63. Group IIA elements, M, react with oxygen, O, to form oxides with the formula
   a. MO
   b. M₂O
   c. MO₂
   d. M₂O₃

   ANS: a

64. If an element in a group in the periodic table has a combining power (valence) of two, another element in the same group likely has a combining power of _____
   a. two
   b. one or three
   c. an unpredictable number
   d. four or five, depending on the element's position in the group

   ANS: a

65. Why are atoms at the bottom of a group in the periodic table larger than atoms at the top of the group?
   a. larger atoms have more electrons and more occupied energy levels
   b. larger atoms have more protons
   c. larger atoms have more energy levels occupied by electrons
   d. larger atoms have less screening effect by inner electrons

   ANS: a
66. Which atom in the following series is the largest?
   a. K
   b. Rb
   c. Cs
   d. Na

   ANS: c

67. How many electrons in the valence shell of a calcium atom?
   a. 20
   b. 8
   c. 2
   d. 1

   ANS: c

68. According to the periodic table all the elements in Group IIA are
   a. a noble gas
   b. metals
   c. metalloids
   d. nonmetals

   ANS: b

69. The periodic table is helpful in all the following endeavors but one. Which is the exception?
   a. predicting the number of isotopes of elements
   b. predicting chemical reactivity of elements
   c. predicting physical properties of elements
   d. predicting formula of compounds

   ANS: a

70. An element with electronic structure of 2-8-3 is in which of the following groups of the periodic table?
   a. IA
   b. IIA
   c. IIIA
   d. IVA

   ANS: c
71. What general electronic arrangement is characteristic to chemical inactivity?
   a. a total of eight electrons per atom
   b. filled s and p orbitals
   c. all electrons paired
   d. 2-8-8

   ANS: d

72. An element with electronic structure of 2-8-8 is in which of the following groups of the periodic table?
   a. IIA
   b. IVA
   c. VIA
   d. VIIIA

   ANS: d

73. An element with two valence (bonding, or outer shell) electrons is
   a. Mg
   b. Na
   c. Cl
   d. Al

   ANS: a

74. Which of the following reacts most violently with water?
   a. Ne, neon
   b. Na, sodium
   c. Li, lithium
   d. K, potassium

   ANS: d

75. Which of the following elements has five valence electrons?
   a. Be
   b. F
   c. P
   d. Xe

   ANS: c
76. Which law states that matter is neither lost nor gained during a chemical reaction?
   a. Law of multiple proportions
   b. Law of definite proportions
   c. Law of chemical reactions
   d. Law of conservation of mass

   ANS: d

77. Which subatomic particles are found in the nucleus of $^{32}$P atom?
   a. 15 protons, 15 electrons, 17 neutrons
   b. 15 protons, 15 electrons, 32 neutrons
   c. 15 protons, 32 neutrons
   d. 15 protons, 17 neutrons

   ANS: d

78. What is the symbol for a neutral atom with 35 protons, 35 electrons, and 46 neutrons?
   a. Se
   b. Br
   c. Cl
   d. Ti

   ANS: b

79. Which type of electromagnetic radiation has the least amount of energy per photon?
   a. infrared
   b. gamma
   c. radio waves
   d. ultraviolet

   ANS: c

80. Which element has 8 valence electrons?
   a. Be
   b. F
   c. Na
   d. Ne

   ANS: d
81. The fourth energy level can hold a maximum of how many electrons?
   a. 2
   b. 8
   c. 18
   d. 32

   ANS: d

82. How many core electrons (innermost) are found in a nitrogen atom?
   a. 2
   b. 5
   c. 7
   d. 14

   ANS: a

83. Which element has the following ground state electron configuration
   \(1s^22s^22p^63s^23p^64s^1\)?
   a. Ar
   b. Na
   c. K
   d. Cl

   ANS: c

84. Which of the following ground state configurations matches represents an atom with 7
   valence electrons?
   a. \(1s^22s^22p^63s^23p^6\)
   b. \(1s^22s^22p^63s^23p^4\)
   c. \(1s^22s^22p^63s^2\)
   d. \(1s^22s^22p^63s^23p^5\)

   ANS: d
85. What is the ground state configuration for an argon atom?
   a. $1s^2 2s^2 2p^6 3s^2 3p^6$
   b. $1s^2 2s^2 2p^6 3s^2 3p^8$
   c. $1s^2 2s^2 2p^6$
   d. $1s^2 2s^2 2p^6 3s^2$
   ANS: a

86. Which element is found in Group VIA - in Period 3?
   a. phosphorus, P
   b. chromium, Cr
   c. sulfur, S
   d. oxygen, O
   ANS: c

87. Which is a property of metals?
   a. malleable
   b. conductor
   c. lose electrons to form positive ions
   d. all of the above
   ANS: d

88. Which is element is a nonmetal?
   a. potassium
   b. copper
   c. sulfur
   d. lithium
   ANS: c

89. Which element is a halogen?
   a. O
   b. F
   c. Na
   d. Ne
   ANS: b
90. How many valence electrons are in aluminum?
   a. 1
   b. 2
   c. 3
   d. 5

   ANS: c

91. Which element would most likely have the Lewis dot symbol, ·X·?
   a. sodium
   b. magnesium
   c. oxygen
   d. silicon

   ANS: b

92. In the following set, which atom is the largest?
   a. Ar
   b. Mg
   c. Cl
   d. Si

   ANS: b

93. An element with 4 valence (bonding, or outer shell) electrons is
   a. N
   b. Al
   c. Cl
   d. C

   ANS: d