Chapter 2: Atoms and the Periodic Table

1. Which element is a nonmetal?
   A) K B) Co C) Br D) Al
   Ans: C Difficulty: Easy

2. Which element is a metal?
   A) Li
   B) Si
   C) Cl
   D) Ar
   E) More than one of the elements above is a metal.
   Ans: A Difficulty: Easy

3. Which element is a metalloid?
   A) B B) C C) Ar D) Al
   Ans: A Difficulty: Easy

4. What is the mass number of the isotope with the symbol $^{37}_{17}\text{Cl}$?
   A) 17 B) 18 C) 35.45 D) 37
   Ans: D Difficulty: Medium

5. What is the atomic number of the isotope with the symbol $^{37}_{17}\text{Cl}$?
   A) 17 B) 18 C) 35.45 D) 37
   Ans: A Difficulty: Medium

6. How many protons are in the isotope with the symbol $^{37}_{17}\text{Cl}$?
   A) 17 B) 18 C) 35.45 D) 37
   Ans: A Difficulty: Medium

7. Silicon has three naturally occurring isotopes: Si-28, Si-29 and Si-30. If the average atomic mass of silicon is 28.09, which isotope has the highest isotopic abundance?
   A) Si-28
   B) Si-29
   C) Si-30
   D) All isotopes have the same isotopic abundance.
   Ans: A Difficulty: Difficult

8. The active ingredient in the drug Fosamax is a compound with the chemical formula $C_4H_{18}NNaO_{10}P_2$. Which statement concerning the chemical formula of this compound is false?
   A) Atoms of six different elements make up this compound.
   B) Carbon, hydrogen, nitrogen, sodium, oxygen, and potassium atoms are present in this compound.
   C) The ratio of carbon atoms to oxygen atoms is 4:10.
   D) There is only one atom of nitrogen present in this compound.
   Ans: B Difficulty: Medium

9. Which element is a transition metal in period 4?
   A) K B) Hf C) Sn D) Sc
   Ans: D Difficulty: Medium

10. Which element is a noble gas?
    A) H
    B) Ne
    C) Pr
    D) Ra
    E) More than one of the elements listed is a noble gas.
    Ans: B Difficulty: Easy

11. Which element is not an alkali metal?
    A) Li B) K C) Rb D) H E) All of the above elements are alkali metals.
    Ans: D Difficulty: Medium

12. Which element is not an alkali metal?
    A) Li B) Kr C) Rb D) Na E) All of the above elements are alkali metals.
    Ans: B Difficulty: Easy

13. The chemical reactivity of an element is determined by which of the following?
    A) the number of protons in an atom of the element
    B) the number of valence electrons in an atom of the element
    C) the number of neutrons in an atom of the element
    D) the number of protons and neutrons in an atom of the element
    Ans: B Difficulty: Easy

14. The element symbol for manganese is
A) M B) Ma C) Mg D) Mn
Ans: D Difficulty: Medium

15. The element symbol for sulfur is
A) S B) Su C) Sf D) Sl
Ans: A Difficulty: Easy

16. Which statement is not part of the modern description of the electronic structure of an atom?
A) Electrons occupy discrete energy levels.
B) Electrons move freely in space.
C) The energy of electrons is quantized.
D) The energy of electrons is restricted to specific values.
Ans: B Difficulty: Difficult

17. What is the maximum number of electrons that can occupy the third (n=3) shell?
A) 2 B) 3 C) 6 D) 8 E) 18
Ans: E Difficulty: Difficult

18. Which of the following properly represents the order of orbital filling based on the relative energy of the orbitals?
A) 1*s*,2*s*,2*p*,3*s*,3*p*,3*d*,4*s*,4*p*
B) 1*s*,2*s*,3*s*,4*s*,2*p*,3*p*,4*p*,3*d*
C) 1*s*,2*s*,2*p*,3*s*,3*p*,4*s*,3*d*,4*p*
D) 1*s*,2*s*,2*p*,3*s*,3*d*,3*p*,4*s*,4*p*
Ans: C Difficulty: Difficult

19. Which atom has the largest atomic radius?
A) K B) Ga C) Br D) Rb
Ans: D Difficulty: Medium

20. Which atom has the smallest atomic radius?
A) K B) Ga C) Br D) Rb
Ans: C Difficulty: Medium

21. Which element has the smallest ionization energy?
A) K B) Ga C) Br D) Rb
Ans: D Difficulty: Medium

22. How many protons are in the isotope $^{238}_{92}\mathrm{U}$?
A) 238 B) 146 C) 92 D) 330
Ans: C Difficulty: Medium

23. How many neutrons are in the isotope $^{238}_{92}\mathrm{U}$?
A) 238 B) 146 C) 92 D) 330
Ans: B Difficulty: Difficult

24. How many electrons are in the isotope $^{238}_{92}\mathrm{U}$?
A) 238 B) 146 C) 92 D) 330
Ans: C Difficulty: Medium

25. Which isotope is not possible?
A) $^{1}_{1}\mathrm{H}$
B) $^{4}_{9}\mathrm{Be}$
C) $^{241}_{95}\mathrm{Am}$
D) $^{2}_{1}\mathrm{H}$
E) More than one of the above isotopes is not possible.
Ans: B Difficulty: Difficult

26. An atom of the isotope chlorine-37 consists of how many protons, neutrons, and electrons? (p = proton, n = neutron, e = electron)
A) 18 p, 37 n, 18 e
B) 17 p, 20 n, 17 e
C) 17 p, 20 n, 18 e
D) 37 p, 37 n, 17 e
E) 37 p, 20 n, 37 e
Ans: B Difficulty: Medium

27. The elements in a column of the periodic table are collectively referred to as
A) metals B) a period C) a group D) a series E) metalloids
Ans: C Difficulty: Easy

28. Which element is most likely to be a good conductor of electricity?
A) Ar B) N C) F D) Ni E) O
Ans: D Difficulty: Medium

29. Which element is chemically similar to lithium?
A) sulfur B) magnesium C) iron D) lanthanum E) potassium
Ans: E Difficulty: Medium

30. Which element is chemically similar to chlorine?
A) sulfur B) calcium C) oxygen D) bromine E) argon
Ans: D Difficulty: Medium

31. Which element is an *s* block element?
A) S B) Ar C) He D) La E) None of these elements is an *s* block element.
Ans: C Difficulty: Difficult

32. Which element is a *d* block element?
A) S B) Ar C) Ag D) As E) None of these elements is a *d* block element.
Ans: C Difficulty: Medium

33. The proper electron-dot symbol for aluminum is

A) $\cdot\dot{\underset{\cdot}{\text{Al}}}\cdot$ B) $\cdot\text{Al}$ C) $\cdot\ddot{\text{Al}}$ D) $\text{Al}\cdot$

Ans: A Difficulty: Easy

34. The electron configuration of chlorine is $1s^2 2s^2 2p^6 3s^2 3p^5$. Which statement about chlorine is incorrect?

A) chlorine has five valence electrons
B) chlorine's valence shell is the third shell
C) chlorine has five electrons in the 3p subshell
D) chlorine has 17 total electrons

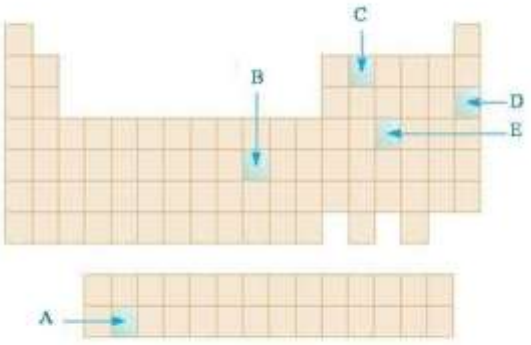
Ans: A Difficulty: Medium

35. What is the symbol for the isotope with $A = 31$ and $Z = 15$?

A) ${}^{15}_{31}\text{P}$ B) ${}^{46}_{15}\text{P}$ C) ${}^{31}_{15}\text{Ga}$ D) ${}^{31}_{15}\text{P}$

Ans: D Difficulty: Medium

36. In the diagram below, which highlighted element is an *f* block element?



A) A B) B C) C D) D E) E

Ans: A Difficulty: Easy

37. Which statement describing atoms is false?

A) The number of protons in an atom is referred to as the atomic number of the atom.
B) The total number of protons, neutrons, and electrons in an atom is referred to as the mass number of the atom.
C) Protons and neutrons are located in the nucleus of an atom.
D) Electrons are located in the space outside the nucleus called the electron cloud.

Ans: B Difficulty: Easy

38. Antimony is a metalloid containing 51 protons that is alloyed with lead and used in car batteries. What is the element symbol for antimony?

A) A B) An C) At D) Sb E) Cr

Ans: D Difficulty: Medium

39. Which statement concerning the elements fluorine, chlorine, bromine, and iodine is incorrect?
    A) These elements are all halogens.
    B) These elements all have the same valence shell.
    C) These elements are all nonmetals.
    D) These elements all have the same number of valence electrons.
    Ans: B Difficulty: Medium

40. A sulfur atom has a larger atomic radius than an oxygen atom. Which statement best explains why?
    A) Sulfur contains more electrons than oxygen does.
    B) Sulfur contains more protons than oxygen does.
    C) The valence shell of sulfur is farther away from the nucleus than the valence shell of oxygen is.
    D) The larger number of protons in an oxygen atom pulls its electrons closer to the nucleus than a sulfur atom.
    Ans: C Difficulty: Difficult

41. Zirconium (Zr) is an element classified as a metal. Which property cannot be assumed based on its classification as a metal?
    A) Zr has a relatively high density
    B) Zr is a trace element in the body
    C) Zr is a good conductor of electricity
    D) Zr is a shiny solid
    Ans: B Difficulty: Medium

42. Protons and electrons reside in the nucleus of an atom.
    Ans: False Difficulty: Easy

43. Electrons are negatively charged and have the smallest mass of the three subatomic particles.
    Ans: True Difficulty: Medium

44. The nucleus contains most of the mass of an atom and is positively charged.
    Ans: True Difficulty: Medium

45. All atoms of the same element contain the same number of protons.
    Ans: True Difficulty: Easy

46. An alloy is a mixture of two or more elements that has metallic properties.
    Ans: True Difficulty: Easy

47. Fl is the element symbol for fluorine.
    Ans: False Difficulty: Easy

48. The element symbol S represents sodium.
    Ans: False Difficulty: Easy

49. Hydrogen is located in group 1A but it is not considered an alkali metal.
Ans: True Difficulty: Medium

50. The element symbol for iron is Fe.
Ans: True Difficulty: Easy

51. Helium is an *s* block element.
Ans: True Difficulty: Difficult

52. Nonmetals have a shiny appearance, and they are generally poor conductors of heat and electricity.
Ans: False Difficulty: Easy

53. All elements have at least two naturally occurring isotopes.
Ans: False Difficulty: Medium

54. Oxygen, carbon, hydrogen, and nitrogen are called the building-block elements because they make up the majority of the mass of the human body.
Ans: True Difficulty: Medium

55. A compound is a pure substance formed by chemically combining two or more elements together.
Ans: True Difficulty: Medium

56. The farther a shell is from the nucleus, the larger its volume becomes, and the more electrons it can hold.
Ans: True Difficulty: Medium

57. The mass of a neutron is equal to the mass of a proton plus the mass of an electron.
Ans: False Difficulty: Easy

58. The 5*s* orbital is lower in energy than the 4*d* orbital.
Ans: True Difficulty: Medium

59. The electron-dot symbol for barium is  .
Ans: False Difficulty: Easy

60. All of the elements in group 2A are metals.
Ans: True Difficulty: Easy

61. All of the elements in group 6A are nonmetals.
Ans: False Difficulty: Medium

62. All metals are solids at room temperature.
Ans: False Difficulty: Medium

63. The maximum number of electrons that can occupy the 3*d* subshell is ten (10).
Ans: True Difficulty: Medium

64. Phosphorus has 15 valence electrons.
Ans: False Difficulty: Medium

65. A bromine atom is smaller than a potassium atom.
Ans: True Difficulty: Medium

66. Iodine has smaller ionization energy than chlorine.
Ans: True Difficulty: Medium

67. The electron configuration for calcium is $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$.
Ans: True Difficulty: Medium

68. When orbitals are equal in energy, one electron is added to each orbital until the orbitals are half-filled, before any orbital is completely filled.
Ans: True Difficulty: Medium

69. When two electrons occupy the same orbital they have paired spins—that is, the spins are opposite in direction.
Ans: True Difficulty: Medium

70. Group 6A elements have the general electron configuration of $ns^2 np^6$.
Ans: False Difficulty: Medium

71. The electron cloud contains most of the volume of an atom.
Ans: True Difficulty: Easy

72. Bromine is abbreviated by the two-letter symbol BR.
Ans: False Difficulty: Easy

73. A column in the periodic table is called a period.
Ans: False Difficulty: Easy

74. An atom with $A = 21$ and $Z = 10$ is an isotope of an atom with $A = 20$ and $Z = 10$.
Ans: True Difficulty: Difficult

75. The atomic weight of an element is the sum of the masses of the naturally occurring isotopes of the element.
Ans: False Difficulty: Medium

76. Strontium and barium have similar chemical properties.
Ans: True Difficulty: Medium

77. The number of electrons that an orbital can contain depends on the type of orbital.
Ans: False Difficulty: Medium

78. Fluorine has higher ionization energy than neon.
Ans: False Difficulty: Medium

79. An iodine atom is larger than both a krypton atom and a tellurium atom.
Ans: False Difficulty: Difficult

80. Radium is a noble gas.
Ans: False Difficulty: Medium

81. The chemical formula S_8 represents a compound.
Ans: False Difficulty: Medium

82. The ground state electron configuration for _____ is $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$.
Ans: potassium or K
Difficulty: Medium

83. The electron configuration of aluminum using the noble gas notation is _____.
Ans: [Ne]$3s^2 3p^1$
Difficulty: Medium

84. The electrons in the outermost shell of an atom are called the _____ electrons.
Ans: valence
Difficulty: Medium

85. The name of the halogen in period 3 is _____.
Ans: chlorine
Difficulty: Medium

86. The isotope $^{49}_{22}\text{Ti}$ has A = _____ and Z = _____.

Ans: 49, 22
Difficulty: Medium

87. Isotopes of the same element have the same number of _____.
Ans: protons
Difficulty: Easy

88. Elements in the same group have the same number of _____.
Ans: valence electrons
Difficulty: Easy

89. Iron-56 contains _____ neutrons.
    Ans: 30 or thirty
    Difficulty: Medium

90. Tungsten is a metal containing 74 protons that is widely used in the electronics industry. What is the elemental symbol for tungsten?
    Ans: W
    Difficulty: Medium