

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) $1s, 2s, 2p, 3s, 3p, 3d, 4s, 4p$
- B) $1s, 2s, 3s, 4s, 2p, 3p, 4p, 3d$
- C) $1s, 2s, 2p, 3s, 3p, 4s, 3d, 4p$
- D) $1s, 2s, 2p, 3s, 3d, 3p, 4s, 4p$

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 $^{238}_{92}\text{U}$?

- A) 238 B) 146 C) 92 D) 330

Ans: C Difficulty: Medium

23. How many neutrons are in the isotope $^{238}_{92}\text{U}$?

- A) 238 B) 146 C) 92 D) 330

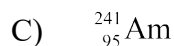
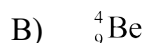
Ans: B Difficulty: Difficult

24. How many electrons are in the isotope $^{238}_{92}\text{U}$?

- A) 238 B) 146 C) 92 D) 330

Ans: C Difficulty: Medium

25. Which isotope is not possible?



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

D) 37 p, 37 n, 17 e

B) 17 p, 20 n, 17 e

E) 37 p, 20 n, 37 e

C) 17 p, 20 n, 18 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.

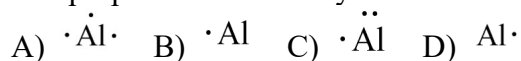
Ans: C Difficulty: Difficult

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



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

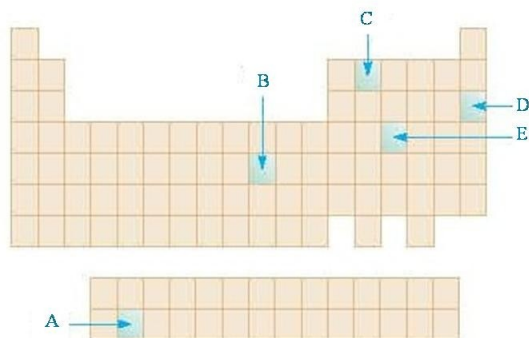
Ans: A Difficulty: Medium

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 **Ba**·.
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 $3d$ 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 $1s^22s^22p^63s^23p^64s^2$.
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^2np^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: $[\text{Ne}]3s^2 3p^1$

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