

Chapter 08: The Periodic Table

1. The *law of octaves* was proposed by
 - A) G. N. Lewis.
 - B) John Newlands.
 - C) Dmitri Mendeleev.
 - D) J. J. Thompson.
 - E) Ernest Rutherford.
3. As opposed to early periodic tables based on the *law of octaves*, modern periodic tables arrange the elements in order of increasing
 - A) nuclear binding energy.
 - B) number of neutrons.
 - C) atomic mass.
 - D) atomic number.
 - E) atomic size.
5. The chief contribution of physicist Henry Moseley to atomic theory was
 - A) the discovery of the periodic law.
 - B) the determination of the charge of the proton.
 - C) the measurement of the atomic numbers of the elements.
 - D) the scientist who determined the electric charge of the electron.
 - E) the discovery of the law of octaves.
7. The elements in Group 2A are known by what name?
 - A) transition metals
 - B) halogens
 - C) alkali metals
 - D) alkaline earth metals
 - E) noble gases
9. Which one of the following elements is a transition element?
 - A) Sr
 - B) Pb
 - C) As
 - D) Fe
 - E) H
11. The general electron configuration for atoms of all elements in Group 5A is
 - A) ns^2np^6
 - B) ns^2np^5
 - C) ns^2np^4
 - D) ns^2np^3
 - E) ns^2np^1
13. The general electron configuration for atoms of the halogen group is
 - A) ns^2np^6 .
 - B) ns^2np^5 .
 - C) $ns^2np^6(n-1)d^7$.
 - D) ns^1 .
 - E) ns^2np^7 .
15. An element with the general electron configuration for its outermost electrons of ns^2np^1 would be in which element group?
 - A) 2A
 - B) 3A
 - C) 4A
 - D) 5A
 - E) 8A

17. Consider the element with the electron configuration $[\text{Kr}]5s^24d^7$. This element is
 A) a representative element. D) an actinide element.
 B) a transition metal. E) a noble gas.
 C) a nonmetal.
19. Consider the element with the electron configuration $[\text{Xe}]6s^24f^7$. This element is
 A) a representative element. D) an actinide element.
 B) a lanthanide element. E) a noble gas.
 C) a nonmetal.
21. How many *valence electrons* does an oxygen atom have?
 A) 2 B) 4 C) 6 D) 7 E) 8
23. How many electrons are in the $4p$ orbitals of selenium?
 A) 0 B) 2 C) 4 D) 5 E) 6
25. What is the charge on the monatomic ion that calcium forms in its compounds?
 A) +2 B) +1 C) -1 D) -2 E) -3
27. What is the charge on the stable ion formed by selenium?
 A) +2 B) +1 C) -1 D) -2 E) -3
29. Which two electron configurations represent elements that would have similar chemical properties?
 (1) $1s^22s^22p^4$ (2) $1s^22s^22p^5$ (3) $[\text{Ar}]4s^23d^5$ (4) $[\text{Ar}]4s^23d^{10}4p^5$
 A) (1) and (2) B) (1) and (3) C) (2) and (3) D) (2) and (4) E) (3) and (4)
31. Which one of the following pairs are *isoelectronic*?
 A) Mn^{2+} and Ar D) Cl^- and S
 B) Zn^{2+} and Cu^{2+} E) K^+ and Cl^-
 C) Na^+ and K^+
33. Which ion is *isoelectronic* with Ar?
 A) Fe^{2+} B) F^- C) Br^- D) Ga^{3+} E) Ca^{2+}

35. Which of the following is the electron configuration for the aluminum ion?
 A) $1s^2 2s^2 2p^6 3s^2$ D) $1s^2 2s^2 2p^6$
 B) $1s^2 2s^2 2p^6 3s^2 3p^2$ E) $1s^2 2s^2 2p^6 3s^2 3p^4$
 C) $1s^2 2s^2 2p^6 3s^2 3p^1$
37. Which of the following is the electron configuration of a sulfide ion?
 A) $[\text{Ne}]3s^2 3p^4$ B) $[\text{Ne}]$ C) $[\text{Ne}]3s^2 3p^1$ D) $[\text{Ar}]$ E) $[\text{Ne}]3s^2 3p^2$
39. The electron configuration of a copper(I) ion is
 A) $[\text{Ar}]4s^2 3d^8$ B) $[\text{Ar}]4s^1 3d^9$ C) $[\text{Ar}]3d^{10}$ D) $[\text{Ar}]4s^2 3d^6 4p^2$ E) $[\text{Kr}]$
41. Which one of the following does *not* have $[\text{Kr}]$ as its electronic configuration?
 A) Se^{2-} B) Br^- C) Rb^+ D) Y^{3+} E) Zn^{2+}
43. The cobalt(III) ion, Co^{3+} , has how many $3d$ electrons?
 A) 0 B) 7 C) 6 D) 5 E) 4
45. How many $3d$ electrons does an Fe^{3+} ion have?
 A) 9 B) 6 C) 5 D) 4 E) 3
47. Which of the following ground-state ions has unpaired electrons?
 A) P^{3-} B) V^{5+} C) Mg^{2+} D) Sc^{2+} E) S^{2+}
49. Which of the atoms listed below has the largest radius?
 A) Cl B) I C) P D) Sb E) Se
51. Which one of the following ions has the largest radius?
 A) Cl^- B) K^+ C) S^{2-} D) Na^+ E) O^{2-}
53. Arrange the following ions in order of decreasing ionic radius: Al^{3+} , Mg^{2+} , Na^+ , O^{2-} .
 decreasing radius $\rightarrow$
 A) $\text{Al}^{3+} > \text{Mg}^{2+} > \text{O}^{2-} > \text{Na}^+$ D) $\text{O}^{2-} > \text{Al}^{3+} > \text{Mg}^{2+} > \text{Na}^+$
 B) $\text{Al}^{3+} > \text{Mg}^{2+} > \text{Na}^+ > \text{O}^{2-}$ E) $\text{O}^{2-} > \text{Na}^+ > \text{Mg}^{2+} > \text{Al}^{3+}$
 C) $\text{Na}^+ > \text{Mg}^{2+} > \text{Al}^{3+} > \text{O}^{2-}$

55. For which of the following reactions is the enthalpy change equal to the third ionization energy of vanadium?
- A) $V^{2+}(g) \rightarrow V^{3+}(g) + e^{-}$ D) $V^{2-}(g) + e^{-} \rightarrow V^{3-}(g)$
B) $V^{3+}(g) + e^{-} \rightarrow V^{2+}(g)$ E) $V^{3+}(g) \rightarrow V^{4+}(g) + e^{-}$
C) $V(g) \rightarrow V^{3+}(g) + 3e^{-}$
57. Which of the elements listed below has the highest first ionization energy?
- A) C B) Ge C) P D) O E) Se
59. Which of the following elements has the smallest first ionization energy?
- A) Cl B) Na C) Be D) K E) As
61. Which element will display an unusually large jump in ionization energy values between I_3 and I_4 , its third and fourth ionization energies?
- A) Na B) Mg C) Al D) Si E) P
63. For phosphorus atoms, which ionization energy will show an exceptionally large increase over the previous ionization energy?
- A) 2nd B) 3rd C) 4th D) 5th E) 6th
65. The successive ionization energies of a certain element are $I_1 = 589.5$ kJ/mol, $I_2 = 1145$ kJ/mol, $I_3 = 4900$ kJ/mol, $I_4 = 6500$ kJ/mol, and $I_5 = 8100$ kJ/mol. This pattern of ionization energies suggests that the unknown element is
- A) K. B) Si. C) As. D) Ca. E) S.
67. Which of the following elements has the greatest electron affinity (largest positive value)?
- A) Mg B) Al C) Si D) P E) S
69. Which of the following atoms has the greatest electron affinity (largest positive value)?
- A) S B) P C) Ga D) Li E) Br

71. The first ionization energy of mercury is 1006 kJ/mol. The energy change for the reaction $\text{Hg(l)} \rightarrow \text{Hg}^+(\text{g}) + \text{e}^-$ is therefore
- 1006 kJ/mol.
 - greater than 1006 kJ/mol.
 - less than 1006 kJ/mol.
 - is equal to the electron affinity of mercury.
 - is equal to the second ionization energy of mercury.
73. Which pair of elements from different groups resemble each other the most in their chemical properties?
- Be and B
 - Al and Si
 - Li and Be
 - Al and Be
 - Be and C
75. Which of the following elements has the greatest metallic character?
- Br
 - F
 - Ge
 - Mn
 - Sc
77. Which of the following elements has the greatest metallic character?
- Ca
 - Mg
 - Ba
 - As
 - Se
79. Which of the following is an *amphoteric* oxide?
- Na_2O
 - MgO
 - Al_2O_3
 - SO_2
 - Cl_2O_7
81. Which of the following is an *acidic* oxide?
- P_4O_{10}
 - MgO
 - Fe_2O_3
 - K_2O
 - Cr_2O_3
83. Which of the following is a *basic* oxide?
- NO_2
 - H_2O
 - Na_2O
 - SnO
 - SO_2
85. Since zirconium is a metal, ZrO_2 is expected to be a/an _____ oxide.
- acidic
 - ionic
 - amphoteric
 - neutral
 - basic
87. Which of the following elements behaves chemically similarly to potassium?
- magnesium
 - sodium
 - beryllium
 - chlorine
 - iron

89. Which of the following elements behaves chemically similarly to silver?
A) nickel B) gold C) sulfur D) chlorine E) iron F) beryllium
91. Consider the following reaction: $3\text{Li} + \text{Z} \rightarrow \text{Li}_3\text{Z}$.
What is the formula for the compound if we substitute sodium for lithium?
A) NaZ B) Na_2Z C) NaZ_2 D) Na_3Z E) NaZ_3
93. Consider the following reaction $2\text{A} + 3\text{F}_2 \rightarrow 2\text{AF}_3$.
What is the formula for the reaction product if we substitute iodine for fluorine?
A) A_2I_3 B) A_3I_2 C) AI_3 D) A_3I E) AI