

Assessment

Chapter Test B

Chapter: The Periodic Law

PART I In the space provided, write the letter of the term or phrase that best completes each statement or best answers each question.

- _____ 1. In his periodic table, Mendeleev did not list all of the elements in order of increasing atomic mass because he wanted to group together elements with similar
- a. properties.
 - b. atomic numbers.
 - c. isotopes.
 - d. charges.
- _____ 2. A new group was added to Mendeleev's periodic table after the discovery of
- a. alkali metals.
 - b. electrons.
 - c. noble gases.
 - d. atomic nuclei.
- _____ 3. Moseley discovered that elements with similar properties occurred at regular intervals when the elements were arranged in order of increasing
- a. atomic mass.
 - b. density.
 - c. radioactivity.
 - d. atomic number.
- _____ 4. Compared with the elements at the left end of the *p*-block element group, the elements at the right end
- a. have larger radii.
 - b. are all solids at 0°C.
 - c. have lower ionization energies.
 - d. are less metallic.
- _____ 5. As the atomic number increases within a group of elements, the atomic radius
- a. generally increases.
 - b. remains generally constant.
 - c. decreases regularly.
 - d. varies unpredictably.

Chapter Test B, *continued*

- _____ 6. For each successive electron removed from an atom, the ionization energy
- a. increases.
 - b. decreases.
 - c. remains the same.
 - d. equals the nuclear charge.
- _____ 7. The halogens are located on the periodic table in Group
- a. 1.
 - b. 2.
 - c. 17.
 - d. 18.
- _____ 8. The number of valence electrons for Group 2 elements is
- a. 2.
 - b. 8.
 - c. $n-1$.
 - d. equal to the period number.

PART II Write the correct term (or terms) in the space provided.

9. The elements with atomic numbers from 58 through 71 in the periodic table are called the _____.
10. Since the first energy level contains only the 1s sublevel, the number of elements in this period is _____.
11. The electron configuration of an element in its ground state is $[\text{Ar}]3d^{10}4s^24p^5$.
This element is in the _____ period.
12. Elements whose atoms contain partially filled *d* sublevels when they are in the ground state are called _____.
13. For elements in groups 1, 2, and 18, the increase in atomic number for successive elements follows the pattern 8, 8, 18, 18,
_____.
14. The electrons available to be gained, lost, or shared in the formation of chemical compounds are called _____.
15. The energy change when an electron is acquired by a neutral atom is called the _____ of the atom.

Chapter Test B, *continued*

- 16.** The measure of the ability of an atom in a chemical compound to attract electrons from another atom in the compound is called _____.
- 17.** The energy required to remove one electron from an atom is called its _____.
- 18.** The valence electron configuration for the Group 16 element in Period 3 is _____.
- 19.** One-half the distance between the nuclei of identical atoms that are bonded together is the _____.
- 20.** An atom or group of bonded atoms that has a positive or negative charge is called a(n) _____.

PART III Write the answers to the following questions in the space provided.

- 21.** List the group, period, and block in which the element with the electron configuration $[\text{Rn}]7s^1$ is located.
- _____
- 22.** How do the properties of the transition elements compare with those of the alkali metals and alkaline-earth metals?
- _____
- _____
- _____
- 23.** Of the following elements, which has the largest atomic radius: sodium (atomic number 11), magnesium (atomic number 12), phosphorus (atomic number 15), and chlorine (atomic number 17). Explain your answer in terms of trends in the periodic table.
- _____
- _____
- _____

Chapter Test B, *continued*

- 24.** Describe the general trends in ionization energies down a group and across a period.

- 25.** Why are elements with high electron affinities also the most electronegative?

- 26.** State the periodic law.

- 27.** How do the sizes of a cation and an anion compare with the sizes of the neutral atoms from which they are formed?

PART IV On the line at the left of each term in the first column, write the letter of the expression in the second column that is most closely related.

- | | |
|--|--|
| 28. _____ main group elements | a. Group 1 elements |
| 29. _____ lanthanides and actinides | b. elements that make up the <i>f</i> block |
| 30. _____ transition elements | c. elements of the <i>s</i> and <i>p</i> blocks |
| 31. _____ alkali metals | d. Group 17 elements |
| 32. _____ halogens | e. entire set of <i>d</i> -block elements |

Chapter Test B, *continued*

PART V

In the space provided, identify the period and block to which each of the following elements belongs.

33. Strontium: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 5s^2$

34. Krypton: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6$

35. Chromium: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$

In the space provided, write the ground-state valence electron configuration for each of the following elements.

36. Group 7, Period 4

37. Group 15, Period 3

38. Group 12, Period 6

In the space provided, list the charge of the ion most likely to be formed from the element and the name of the noble gas with an electron configuration achieved by that formation. (The atomic numbers of the noble gases are: He, 2; Ne, 10; Ar, 18; Kr, 36; Xe, 54; and Rn, 86.)

39. lithium (atomic number 3)

40. oxygen (atomic number 8)

41. sulfur (atomic number 16)

42. aluminum (atomic number 13)

40. 7.05×10^{16} Hz
 41. 1.28 s
 42. 4.58×10^{-19} J

5 The Periodic Law,

pp. 36–45

TEST A

- | | |
|-------|-------|
| 1. b | 2. d |
| 3. b | 4. b |
| 5. d | 6. a |
| 7. b | 8. b |
| 9. b | 10. a |
| 11. c | 12. a |
| 13. c | 14. d |
| 15. c | 16. b |
| 17. d | 18. a |
| 19. d | 20. c |
| 21. d | 22. a |
| 23. a | 24. d |
| 25. b | |

TEST B

- | | |
|------|------|
| 1. a | 2. c |
| 3. d | 4. d |
| 5. a | 6. a |
| 7. c | 8. a |
9. lanthanides
 10. 2
 11. fourth
 12. transition elements
 13. 32
 14. valence electrons
 15. electron affinity
 16. electronegativity
 17. ionization energy
 18. $3s^2 3p^4$
 19. atomic radius
 20. ion
 21. Group 1, Period 7, s block
 22. All three groups of elements are metals. Alkali and alkaline-earth metals are so reactive that they are not found in nature as free elements. Transition elements are generally less reactive. Some are so unreactive that they do not form compounds easily and exist as free elements in nature.
 23. Sodium has the largest atomic radius. All the elements belong to Period 3, but sodium has the lowest atomic number and is therefore the first ele-

ment in Period 3. Atomic radii decrease as you move from left to right across a period.

24. In general, ionization energies of main-group elements increase from left to right across a period and decrease down a group.
 25. Electron affinity and electronegativity are related. Electron affinity is a measure of the ease with which an atom gains electrons. Electronegativity is a measure of the ability of an atom to attract electrons. Therefore, atoms with a high negative electron affinity are also the most electronegative.
 26. The physical and chemical properties of the elements are periodic functions of their atomic numbers.
 27. The ionic radii of cations are always smaller than the atomic radii of the neutral atoms from which they are formed. The ionic radii of anions are always larger than the atomic radii of the neutral atoms from which they are formed.
 28. c
 29. b
 30. e
 31. a
 32. d
 33. Period 5, s block
 34. Period 4, p block
 35. Period 4, d block
 36. $3d^5 4s^2$
 37. $3s^2 3p^3$
 38. $4f^{14} 5d^{10} 6s^2$
 39. 1+, helium
 40. 2-, neon
 41. 2-, argon
 42. 3+, neon

6 Chemical Bonding,

pp. 46–55

TEST A

- | | |
|-------|-------|
| 1. c | 2. b |
| 3. c | 4. c |
| 5. a | 6. d |
| 7. c | 8. b |
| 9. c | 10. b |
| 11. b | 12. c |
| 13. a | 14. a |