

## 14

## CHEMICAL PERIODICITY

**SECTION 14.1 CLASSIFICATION OF THE ELEMENTS (pages 391–396)**

*This section explains why you can infer the properties of an element based on the properties of other elements in the periodic table. It also describes the use of electron configurations to classify elements.*

**► The Periodic Table Revisited (page 391)**

- In 1871, Russian chemist \_\_\_\_\_ created the forerunner of the modern periodic table.
- List four things, other than the name and symbol, one can discover about an element using the periodic table in Figure 14.2.
  - \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_
- How can the periodic table be used to predict the properties of the elements?  
 \_\_\_\_\_  
 \_\_\_\_\_

**► Classifying Elements by Electron Configuration (pages 391–396)**

- Is the following sentence true or false? The subatomic particles that play the most significant role in determining the physical and chemical properties of an element are its electrons. \_\_\_\_\_
- Complete the table about classifying elements according to their electron configurations.

Category	Description of Electron Configuration	Group
Noble gases		
Representative elements		
	outermost <i>s</i> sublevel and nearby <i>d</i> sublevel contain electrons	Group B
	outermost <i>s</i> sublevel and nearby <i>f</i> sublevel contain electrons	Group B

## CHAPTER 14, Chemical Periodicity (continued)

Match the category of elements with an element from that category.

- |                                  |             |
|----------------------------------|-------------|
| _____ 6. Noble gases             | a. gallium  |
| _____ 7. Representative elements | b. nobelium |
| _____ 8. Transition metals       | c. argon    |
| _____ 9. Inner transition metals | d. vanadium |

10. Circle the letter of the elements found in the *p* block.

- a. Groups 1A and 2A and helium
- b. Groups 3A, 4A, 5A, 6A, 7A, and 0 except for helium
- c. transition metals
- d. inner transition metals

11. How many electrons can each type of orbital sublevel contain?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

12. Use Figure 14.5 on page 395. Write the electron configurations for the following elements.

- a. magnesium \_\_\_\_\_
- b. cobalt \_\_\_\_\_
- c. sulfur \_\_\_\_\_

## SECTION 14.2 PERIODIC TRENDS (pages 398–406)

*This section explains how to interpret group trends and periodic trends in atomic radii, ionic radii, ionization energies, and electronegativities.*

### ► Trends in Atomic Size (pages 398–401)

- Is the following sentence true or false? The radius of an atom can be measured directly. \_\_\_\_\_
- What are the atomic radii for the following diatomic molecules?



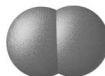
**Hydrogen**  
atomic radius =

\_\_\_\_\_



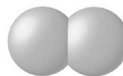
**Oxygen**  
atomic radius =

\_\_\_\_\_



**Nitrogen**  
atomic radius =

\_\_\_\_\_



**Chlorine**  
atomic radius =

\_\_\_\_\_

3. Use Figure 14.8 on page 399. What trend do you see in the sizes of elements within a group? Within a period?

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4. What is the name of the effect that is responsible for differences in atomic radii between elements in the same group? \_\_\_\_\_

5. Number the following elements according to relative size from largest (1) to smallest (4).

\_\_\_\_\_ P

\_\_\_\_\_ He

\_\_\_\_\_ Ca

\_\_\_\_\_ Cs

► **Trends in Ionization Energy (pages 401–403)**

6. \_\_\_\_\_ is the energy required to overcome the attraction of the nuclear charge and remove an electron from a gaseous atom.

7. Why does ionization energy increase as you move across a period, but decrease as you move down a group?

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8. Suppose there is a large increase in energy between the second and the third ionization energies of a metal. What kind of ion is the metal likely to form?

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► **Trends in Ionic Size (pages 403–404)**

9. Metallic elements easily form \_\_\_\_\_ ions; nonmetallic elements readily form \_\_\_\_\_ ions.

10. Circle the letter of the statement that is true about ion size.

- a. Cations are always smaller than the neutral atoms from which they form.
- b. Anions are always smaller than the neutral atoms from which they form.
- c. Within a period, cations with greater charge have larger ionic radii.
- d. Within a group, cations with greater atomic number have smaller ionic radii.

11. Which ion has the larger ionic radius:  $\text{Ca}^{2+}$  or  $\text{Cl}^-$ ? \_\_\_\_\_

**CHAPTER 14, Chemical Periodicity** (*continued*)▶ **Trends in Electronegativity** (page 405)

12. What property of an element represents its tendency to attract electrons when it chemically combines with another element? \_\_\_\_\_

13. Use Table 14.2 on page 405. What trend do you see in the relative electronegativity values of elements within a group? Within a period?

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14. Circle the letter of each statement that is true about electronegativity values.

- a. The electronegativity values of the transition elements are all zero.
- b. The element with the highest electronegativity value is sodium.
- c. Nonmetals have higher electronegativity values than metals.
- d. Electronegativity values can help predict the types of bonds atoms form.

▶ **Summary of Periodic Trends** (page 406)

15. Use Figure 14.16 on page 406. Circle the letter of each property for which aluminum has a greater value than silicon.

- a. first ionization energy
- b. atomic radius
- c. electronegativity
- d. ionic radius

**Reading Skill Practice**

A graph can help you understand comparisons of data at a glance. Use graph paper to make a graph of the data in Table 14.2 on page 405. The vertical axis of your graph should represent electronegativity values and range from 0 to 4. The horizontal axis should represent atomic number. Label each period and the first element in each period.