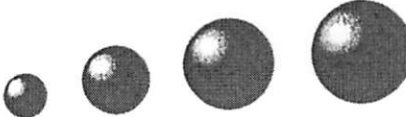


## Understanding Concepts

52. Construct a table that shows the relationship among the group number, valence electrons lost or gained, and the formula of the cation or anion produced for the following metallic and nonmetallic elements: Na, Ca, Al, N, S, Br.
53. Write electron dot formulas for the following atoms.
- |       |       |
|-------|-------|
| a. C  | b. Be |
| c. O  | d. F  |
| e. Na | f. P  |
54. Show the relationship between the electron dot structure of an element and the location of the element in the periodic table.
55. In terms of electrons, why does a cation have a positive charge?
56. Why does an anion have a negative charge?
57. The spheres below represent the relative diameters of atoms or ions. Rearrange the sequences in a. and b. so the relative sizes of the particles correspond to the increasing size of the particles as shown in the illustration.
- 
- |   |
|---|
| a. oxygen atom, oxide ion, sulfur atom, sulfide ion       |
| b. sodium atom, sodium ion, potassium atom, potassium ion |
58. Write electron configurations for the  $2+$  cations of these elements.
- |       |       |
|-------|-------|
| a. Fe | b. Co |
| c. Ni |       |
59. Write electron configurations for the  $3+$  cations of these elements.
- |             |              |
|-------------|--------------|
| a. chromium | b. manganese |
| c. iron     |              |
60. The atoms of the noble gas elements are stable. Explain.
61. Write the formula for the ion formed when each element gains electrons and attains a noble-gas configuration.
- |       |       |
|-------|-------|
| a. Br | b. H  |
| c. As | d. Se |
62. Write electron configurations for these atoms and ions, and comment on the result.
- |                    |                    |
|--------------------|--------------------|
| a. Ar              | b. $\text{Cl}^-$   |
| c. $\text{S}^{2-}$ | d. $\text{P}^{3-}$ |
63. Write electron configurations for the following and comment on the result.
- |                    |                    |
|--------------------|--------------------|
| a. $\text{N}^{3-}$ | b. $\text{O}^{2-}$ |
| c. $\text{F}^-$    | d. Ne              |
64. Name the first four halogens. What group are they in, and how many valence electrons does each have?
65. Write complete electron configurations for the following atoms and ions. For each group, comment on the results.
- |  |
|--|
| a. Ar, $\text{K}^+$ , $\text{Ca}^{2+}$                     |
| b. Ne, $\text{Na}^+$ , $\text{Mg}^{2+}$ , $\text{Al}^{3+}$ |
66. If ionic compounds are composed of charged particles (ions), why isn't every ionic compound either positively or negatively charged?
67. Which of the following substances are most likely not ionic?
- |                         |                          |
|-------------------------|--------------------------|
| a. $\text{H}_2\text{O}$ | b. $\text{Na}_2\text{O}$ |
| c. $\text{CO}_2$        | d. $\text{CaS}$          |
| e. $\text{SO}_2$        | f. $\text{NH}_3$         |
68. Can you predict the coordination number of a ion from the formula of an ionic compound? Explain.
69. Metallic cobalt crystallizes in a hexagonal close-packed structure. How many neighbors will a cobalt atom have?
70. Explain how hexagonal close-packed, face-centered cubic, and body-centered cubic unit cells are different from one another.
71. The properties of all samples of brass are not identical. Explain.

# Assessment

## Content

Two ways that an ion forms from an atom are by losing or gaining electrons. Write the number of electrons either lost or gained in forming each ion.

- $\text{Na}^+$
- $\text{Ca}^{2+}$
- $\text{H}^-$

Identify each ion in Problem 31. Identify each as an anion or a cation.

Write the number of valence electrons.

How many electrons does each atom have? What is the number of valence electrons in each?

- nitrogen
- lithium
- phosphorus
- barium
- iodine
- carbon

Write the electron dot structures for each of the following elements.

- Cl
- S
- Al
- Li

How many electrons must each atom lose to attain a noble-gas electron configuration?

- Ca
- Al
- H
- Ba

Write the formula for the ion formed when each of the following elements loses its valence electrons.

- aluminum
- lithium
- barium
- potassium
- calcium
- strontium

Why do nonmetals tend to form anions when they react to form compounds?

What is the formula of the ion formed when the following elements gain or lose valence electrons and attain noble-gas configurations?

- sulfur
- sodium
- fluorine
- phosphorus

How many electrons must be gained by each of the following atoms to achieve a stable electron configuration?

- N
- S
- Cl
- P

## 7.2 Ionic Bonds and Ionic Compounds

- Which of the following pairs of atoms would you expect to combine chemically to form an ionic compound?
  - Li and S
  - O and S
  - Al and O
  - F and Cl
  - I and K
  - H and N
- Identify the kinds of ions that form each ionic compound.
  - calcium fluoride,  $\text{CaF}_2$
  - aluminum bromide,  $\text{AlBr}_3$
  - lithium oxide,  $\text{Li}_2\text{O}$
  - aluminum sulfide,  $\text{Al}_2\text{S}_3$
  - potassium nitride,  $\text{K}_3\text{N}$
- Explain why ionic compounds are electrically neutral.
- Which of the following pairs of elements will not form ionic compounds?
  - sulfur and oxygen
  - sodium and calcium
  - sodium and sulfur
  - oxygen and chlorine
- Write the formula for the ions in the following compounds.
  - KCl
  - $\text{BaSO}_4$
  - $\text{MgBr}_2$
  - $\text{Li}_2\text{CO}_3$
- Most ionic substances are brittle. Why?
- Explain why molten  $\text{MgCl}_2$  does conduct an electric current although crystalline  $\text{MgCl}_2$  does not.

## 7.3 Bonding in Metals

- Explain briefly why metals are good conductors of electricity.
- Name the three crystal arrangements of closely packed metal atoms. Give an example of a metal that crystallizes in each arrangement.
- Name some alloys that you have used or seen today.
- Explain why the properties of all steels are not identical.