

**Chemical Bonds****Objective 3****PRACTICE SET: Ionic Bonding - The Gain or Loss of Electrons**

Each of the following elements is capable of bonding ionically with other selected elements. Complete the chart by identifying the atomic number, the number of protons and electrons, the number of valence electrons, and the number of electrons lost or gained.

Element	Atomic Number	No. of Protons	No. of Electrons	No. of Valence Electrons	Gains or Loses	No. Electrons Lost or Gained
Lithium						
Beryllium						
Nitrogen						
Oxygen						
Fluorine						
Sodium						
Magnesium						
Sulfur						
Chlorine						

# 7-1 Review and Reinforcement

## Ionic Bonding

Complete each of the following sentences by filling in the appropriate word or phrase from the list below.

- |            |           |        |                        |
|------------|-----------|--------|------------------------|
| negative   | noble gas | octet  | electron configuration |
| positive   | electrons | ions   | polyatomic             |
| crisscross | anion     | cation | empirical formula      |

1. An ionic bond is an attraction between oppositely charged \_\_\_\_\_.
2. Anions have a \_\_\_\_\_ charge.
3. An atom becomes an ion by losing or gaining \_\_\_\_\_.
4. The \_\_\_\_\_ rule states that atoms tend to gain, lose, or share electrons in order to acquire a full set of valence electrons.
5. When sodium and chlorine form an ionic bond, both ions acquire the electron configuration of a(n) \_\_\_\_\_.
6. The atoms that make up \_\_\_\_\_ ions are bonded together by covalent bonds.
7. The \_\_\_\_\_ method can be used to write the formula for an ionic compound.
8. The \_\_\_\_\_ of a compound denotes the ratio of ions in the compound.

If the statement is true, write "true." If it is false, change the underlined word or words to make it true. Write your answer on the line.

- \_\_\_\_\_ 9. Calcium becomes a monatomic cation by gaining two electrons.
- \_\_\_\_\_ 10. A cation has a positive charge.
- \_\_\_\_\_ 11. A binary ionic compound contains only one kind of cation and one kind of anion.
- \_\_\_\_\_ 12. Monatomic ions consist of more than one atom.
- \_\_\_\_\_ 13. The Lewis dot diagram for chlorine, a group 7A element, has six electrons.
- \_\_\_\_\_ 14. A great deal of energy is produced when an ionic compound is formed.

16. Cl

20. Na

17. O

21. Al

18. Ne

22. Mg

*Write the chemical formula for each of the following ionic compounds.*

\_\_\_\_\_ 23. aluminum sulfide

\_\_\_\_\_ 24. ammonium carbonate

\_\_\_\_\_ 25. calcium oxide

\_\_\_\_\_ 26. strontium chloride

\_\_\_\_\_ 27. potassium oxide

\_\_\_\_\_ 28. sodium fluoride

Name \_\_\_\_\_  
Date \_\_\_\_\_ Per. \_\_\_\_\_

**Chemical Bonds**  
**Objectives 3 and 4**  
**PRACTICE SET: Illustrating Ionic Bonding**

**PART A**

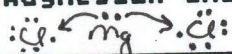
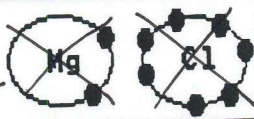
In each of the following pairs of atoms identify the atom that donates electrons by placing a **D** in the blank on the right of the atom. Identify the atom in each pair that gains electrons by placing a **G** in the blank to the right of the atom.

1. Mg \_\_\_\_\_ Cl \_\_\_\_\_
2. Br \_\_\_\_\_ Ca \_\_\_\_\_
3. I \_\_\_\_\_ K \_\_\_\_\_
4. Na \_\_\_\_\_ O \_\_\_\_\_
5. F \_\_\_\_\_ Be \_\_\_\_\_

**PART B**

Show the ionic bonding between the following combinations of atoms using ~~Bohr models~~ <sup>Lewis Dot diagrams</sup>. Draw the valence electrons on the outer energy level. Show the electron transfer. Determine the resulting charge on each atom. Write the chemical formula for each compound.

Lewis Dot Diagrams

Atoms	<del>Bohr Models</del>	Ion Charges	Chemical Formula
Magnesium and chlorine 		Mg <sup>2+</sup> Cl <sup>1-</sup>	MgCl <sub>2</sub>
1. Lithium and chlorine			
2. Potassium and iodine			
3. Sodium and bromine			

Atoms	Bohr Models	Ion Charges	Chemical Formula
4. Rubidium and chlorine			
5. Beryllium and Iodine			
6. Calcium and fluorine			
7. Barium and oxygen			

**PART C**

Identify the bonds in the following compounds as ionic or covalent.

1. NaCl \_\_\_\_\_
2. Br<sub>2</sub> \_\_\_\_\_
3. MgS \_\_\_\_\_
4. BeO \_\_\_\_\_
5. MgF<sub>2</sub> \_\_\_\_\_
6. H<sub>2</sub>O \_\_\_\_\_
7. SO<sub>2</sub> \_\_\_\_\_
8. SiO<sub>2</sub> \_\_\_\_\_
9. Cl<sub>2</sub> \_\_\_\_\_
10. CCl<sub>4</sub> \_\_\_\_\_
11. CO<sub>2</sub> \_\_\_\_\_
12. LiCl \_\_\_\_\_
13. KBr \_\_\_\_\_
14. NO<sub>2</sub> \_\_\_\_\_
15. I<sub>2</sub> \_\_\_\_\_

# Activity 4-4

## The Chemical Bond I

### Introduction

1. What is a chemical bond? \_\_\_\_\_  
\_\_\_\_\_
2. How does potential (stored) energy change when a chemical bond is formed? \_\_\_\_\_  
\_\_\_\_\_
- When a chemical bond is broken? \_\_\_\_\_  
\_\_\_\_\_
3. Compare the potential energy of two atoms in chemically bonded condition to their energy when separated. \_\_\_\_\_  
\_\_\_\_\_
4. Generally, systems at lower potential energy are \_\_\_\_\_ (more/less) stable than systems at higher potential energy.
5. How is the stability of a substance related to the potential energy of that substance? \_\_\_\_\_  
\_\_\_\_\_
6. Describe two ways in which the valence electrons of atoms participate in bond formation.  
\_\_\_\_\_  
\_\_\_\_\_

### Ionic bonds

7. What is an ionic bond? \_\_\_\_\_  
\_\_\_\_\_
8. What other name is sometimes given to ionic bonds? \_\_\_\_\_
9. How are positive ions formed? \_\_\_\_\_  
\_\_\_\_\_
10. How are negative ions formed? \_\_\_\_\_  
\_\_\_\_\_
11. When an atom loses one or more electrons to form a positive ion, energy is \_\_\_\_\_  
\_\_\_\_\_ (absorbed/released).
12. When an atom gains one or more electrons to form a negative ion, energy is \_\_\_\_\_  
\_\_\_\_\_ (absorbed/released).

## Dot diagrams for ionic compounds

13. Choose words from the word list to fill in the blanks in the following paragraphs relating to the construction of dot diagrams for binary ionic compounds. The list pairs words that have contrasting or related meanings.

### Word List

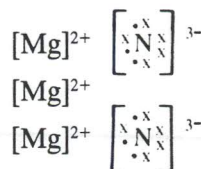
atom/ion	gain/lose	positive/negative
configuration	kernel/valence	symbol
eight	metal/nonmetal	

When atoms form ions, they usually \_\_\_\_\_ or \_\_\_\_\_ enough electrons to achieve the electron \_\_\_\_\_ of a noble gas. Metal atoms \_\_\_\_\_ electrons; nonmetal atoms \_\_\_\_\_ electrons. The electron-dot symbols for elements can be used to construct dot diagrams for ionic compounds. Dot diagrams for monatomic ions show electrons gained or lost. In a dot diagram the \_\_\_\_\_ for the element represents the \_\_\_\_\_ of the ion. Square brackets are used to emphasize the fact that the structure is an \_\_\_\_\_, not an atom. The charge is written outside the brackets.

For \_\_\_\_\_ ions, generally no electrons are indicated since all the \_\_\_\_\_ electrons have been transferred. This accounts for the \_\_\_\_\_ charge of the ion.

For nonmetal ions, generally the number of electrons shown is \_\_\_\_\_ since enough electrons are transferred to the previously partially filled \_\_\_\_\_ shell of the nonmetal atom in order to form the \_\_\_\_\_. Both metal and nonmetal ions have achieved the noble gas \_\_\_\_\_.

In order to represent a binary ionic compound, the appropriate number and kind of ions are used. Thus the dot diagram for the compound  $\text{Mg}_3\text{N}_2$  is:



Construct dot diagrams for the following ionic compounds.

14. NaI

17.  $\text{Na}_2\text{S}$

20. RbBr

15.  $\text{CaF}_2$

18. BaO

21.  $\text{Li}_3\text{N}$

16.  $\text{AlCl}_3$

19.  $\text{K}_3\text{P}$