Name Answer Key Date Class

SECTION 3 Enrichment

The Crisscross Method

The process of writing chemical formulas can be made easier by using oxidation numbers.

Remember that the total charge on a compound must be zero. Remember also that oxidation numbers describe the number of electrons an atom or ion gains or loses when forming compounds. Atoms in the same group on the periodic table usually will have the same oxidation number. Use the periodic table to determine the oxidation numbers of atoms. Refer to your textbook for oxidation numbers of polyatomic ions.

Example: Write the formula for barium chloride.

Step 1: Determine the oxidation numbers for the two elements or ions. Because barium is in Group 2, its oxidation number is 2+. Elements in Group 2 tend to lose the two electrons in the outer energy level, leaving the ions with positive charges. Chloride is in Group 17, so its oxidation number is 1–. Elements in Group 17 have seven electrons in the outer energy level and tend to gain one electron. The ions are negative.

Step 2: Write the chemical symbols in the correct order, with the metal ion first.

Ba Cl

Now, write the oxidation numbers as superscripts. For an ion with an oxidation number of 1+ or 1–, write only the sign and not the number.

Ba^{2+} Cl^-

Next, crisscross the numbers only—not the signs this time, writing the oxidation number of one element as the subscript for the other. Don't write the number 1 here either.

Ba^{2+} Cl^-
Ba Cl_2

Step 3: Determine whether the formula is in its simplest form. Reduce the subscripts to their simplest form by dividing by a common denominator. The formula for barium chloride is $BaCl_2$, which cannot be further reduced.

Step 4: Check the formula by calculating the total positive and total negative charges and confirming that the total charge on the compound is zero.

	Oxidation Number		Subscript		
Barium	(+2)	×	(1)	=	+2
Chlorine	(–1)	×	(2)	=	–2

Directions: *Use the crisscross method to write the chemical formulas for the compounds described below. Check that the total charge on each compound equals zero.*

1. Write the correct chemical formula for a compound containing barium and oxygen. What is the name of this compound?

   BaO Barium oxide

2. Write the formula for zinc iodide, a compound that is used as an antiseptic.

   ZnI_2 zinc iodide

3. One of the uses of ammonium sulfate is in flameproofing fabrics and paper. Write the formula for ammonium sulfate.

   $(NH_4)_2SO_4$

Meeting Individual Needs

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Chapter Review

Chemical Bonds

Part A. Vocabulary Review

Directions: *Complete the sentence by writing the correct terms in the blanks.*

1. An atom that has gained or lost electrons is called a(n) ion.
2. An atom is chemically stable when its outer energy level is filled with electrons.
3. A(n) chemical formula tells what elements make up a compound and the ratios of the atoms of those elements.
4. A molecule that has a positive end and a negative end is a(n) polar molecule.
5. A bond that forms between atoms when they share electrons is a(n) covalent bond.
6. A positive or negative number that is assigned to an element to show its combining ability in a compound is a(n) oxidation number
7. A compound that is composed of only two elements is a(n) binary compound.
8. A group of atoms with a positive or negative charge is a(n) polyatomic ion.
9. A(n) hydrate is a compound that has water chemically attached to its ions.
10. The force of attraction between the opposite charges of the ions in an ionic compound is a(n) ionic bond.
11. Molecules that do not have oppositely charged ends are nonpolar molecules.
12. A(n) chemical bond is formed when atoms gain, lose, or share electrons.

Part B. Concept Review

Directions: *Place a plus sign (+) beside each statement that agrees with what was said in your textbook. Place a minus sign (–) beside each statement that does not agree, and rewrite the statement so that it is correct.*

\+ 1. Compounds have properties unlike those of their elements.

\+ 2. In a chemical formula, a subscript tells how many atoms of an element are in a unit of a compound.

Assessment

Chapter Review (continued)

\+ 3. A chemical bond occurs when atoms lose, gain, or share electrons.

\- 4. Because each noble gas has an outer energy level that is completely filled with electrons, these elements ~~form chemical bonds easily.~~ do not form chemical bonds

\+ 5. Compounds containing polyatomic ions can have both ionic and covalent bonds.

\- 6. A covalent bond is the force of attraction between the opposite charges of the ions in an ionic compound.
A covalent bond is the bond that forms between atoms when they share electrons.

\+ 7. Neutral particles formed as a result of covalent bonding are called molecules.

\- 8. An element that loses electrons when bonding with other atoms has a ~~negative~~ oxidation number.
positive

\+ 9. When writing the formula of a compound, the symbol of the element with the positive oxidation number comes first.

\+ 10. When cobalt chloride unites with water to form cobalt hexahydrate, its formula is written $CoCl_2 \cdot 6H_2O$.

Assessment