Topic 5 – Chemical Formulas and Equations

Lesson 3 – Writing and Naming Chemical Formulas

Terms to Know

Binary Compounds –

Polyatomic Ion Compounds –

Compounds with a Roman Numeral –

Binary Compounds –

Polyatomic Ion Compounds –

Compounds Containing an Atom with Multiple Oxidation Numbers –

Molecular Compounds (Naming with IUPAC Prefixes) –

**Writing Chemical formulas**

* **Binary ionic compounds** have formulas that are composed of two different elements; a metal and a nonmetal

 names of binary compounds always end with –ide

Examples calcium bromide, aluminum sulfide

Step 1 Locate and write down symbols and charges of the elements using the Periodic Table.

Ca+2 Br-1 Al+3 S-2

Step 2 Criss-cross the values of the + and – charges so that each becomes the subscript for the other element

Ca1 Br2 Al2 S3

Step 3 Rewrite the formula

Ca1Br2 Al2S3

Step 4 Write the correct formula (Reduce formulas to empirical formulas, remove subscripts of 1)

CaBr2 Al2S3

* **Polyatomic ion compounds** – contain three or more elements; may contain parentheses

Examples sodium nitrate, calcium sulfite

Step 1 Locate and write down symbols and charges using periodic table and table E; put parentheses around polyatomic ion

Na+1 (NO3)-1  Ca+2 (SO3)-2

Step 2 Criss-Cross values of charges

Na1 (NO3)1 Ca2 (SO3)2

Step 3 Rewrite formula with subscripts but not charges

Na1(NO3)1 Ca2(SO3)2

Step 4 Write the correct formula (reduce subscripts to empirical formula; don’t change subscripts of polyatomic ions; remove parentheses if subscript is 1; remove subscripts of 1

NaNO3  CaSO3

* **Most transition metals have more than one positive oxidation number.** When naming compounds containing transition metals, Roman numerals in parentheses are used to indicate the oxidation number of the transition metals.

Iron (II) chloride II indicates Fe+2

Iron (III) oxide III indicates Fe+3

Lead (IV) nitrate IV indicates Pb+4

Iron (II) chloride

Fe+2 Cl-1 Fe1 Cl2 Fe1Cl2  FeCl2

Chromium (III) sulfate

Cr+3 (SO4)-2 Cr2 (SO4)3 Cr2(SO4)3 Cr2(SO4)3



**Rules for naming molecular (covalent) compounds**

1. The only time a prefix is NOT used is when there is ONLY ONE of the first nonmetal atom.
2. The prefixes are the subscripts
3. NO criss-crossing
4. NO reducing t empirical formula

Phosphorus trichloride

1 phosphorus 3 chlorine

PCl3

Dinitrogen pentoxide

2 nitrogen 5 oxygen

N2O5

**Naming Binary ionic compounds** (formula must have two different symbols – a metal and a nonmetal)

Examples ZnCl2 CaO

Step 1 Locate and write down names of elements in the formula. Confirm that the metal has only one oxidation number.

zinc chlorine calcium oxygen

Step 2 Keep metal’s name; change the nonmetal ending to –ide.

zinc chloride calcium oxide

**Naming compounds with polyatomic ions** (formula must have three or more different elements)

Examples Mg3(PO4)2 NH4NO3

Step 1 Locate and write down the names of symbols in the formula using the Periodic table and table E.

magnesium phosphate ammonium nitrate

Step 2 Write the correct name – keep the name of the metal; keep the name of polyatomic ion

(When NH4 is combined with a nonmetal, the nonmetal ending is changed to –ide)

magnesium phosphate ammonium nitrate

No change is made to the name of the metal or polyatomic ion

**Naming compounds containing transition metals**

Examples CrN2 CuSO4

Step 1 Assign negative charge to nonmetal or polyatomic ion

Cr N2-3 Cu (SO4)-2

Step 2 Find the total negative in the formula (subscript x charge)

2 x -3 = -6 1 x -2 =-2

Step 3 Determine a positive number that when added to the total negative value in step 2 will have a sum of zero.

+6 +2

Step 4 Write the names of symbols in the formula, use the value of + value as Roman numeral, change nonmetal ending to –ide, keep polyatomic ion name

Chromium (VI) nitride copper (II) sulfate

**Naming Binary molecular compounds** (formula must contain two different nonmetals)

Examples P2Cl3 CF4

Step 1 Translate formulas

 2 P 3 Cl 1 C 4 F

Step 2 Name formulas (change numbers to prefixes, write the name of elements after each prefix, keep the name of the first element, change the name of the second nonmetal ending to –ide)

 dinitrogen trichloride carbon tetrafluoride