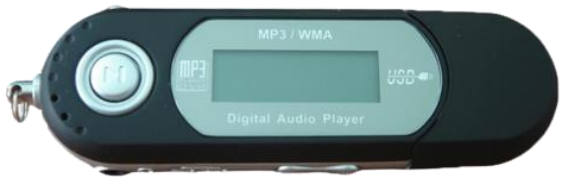
Unit 4.3 Inorganic Binary Compounds Type II



How is an mp3 player designed? In describing many technological items, it's not enough to simply say what brand or model we have. We talk about details such as how much horsepower is "under the hood" for a car or how fast the chip is for our computer. Even a simple device like an mp3 player has more than one size. We can get an 8 MB player, or a 16 MB player. Designation of the item often is incomplete without other information as to its capabilities.

Transition metals have more than one possibility for ion formation (ion charage). In order to name these compounds correctly, we need to be able to indicate which ion is involved in any given compound.

Naming Transition Metal Ions

There are two ways to name the ions that transition metals form. The older system uses the Latin name along with different endings that indicate if the cation carries the higher possible charge or the lower possible charge. Such as:

$FeCl_3$	Ferric chloride	-ic indicates the higher, +3 charge on the Fe
$FeCl_2$	Ferrous chloride	-ous indicates the lower, +2 charge on the Fe

The following chart gives some of the Latin names with the endings according to the charges.

Element	Upper Charge Name	Lower Charge Name
Copper	Cu^{+2} Cupric	Cu^{+1} Cuprous
Iron	Fe^{+3} Ferric	Fe^{+2} Ferrous
Mercury	Hg^{+2} Mercuric	Hg_2^{+2} Mercurous
Lead	Pb^{+4} Plumbic	Pb^{+2} Plumbous
Tin	Sn^{+4} Stannic	Sn^{+2} Stannous
Chromium	Cr^{+3} Chromic	Cr^{+2} Chromous
Manganese	Mn^{+3} Manganic	Mn^{+2} Manganous
Cobalt	Co^{+3} Cobaltic	Co^{+2} Cobaltous

The newer system of naming uses Roman numerals to indicate the charge that the transition metal carries. Using the same example as above:

$FeCl_3$	Iron (III) chloride	III indicates a charge of Fe^{+3}
$FeCl_2$	Iron (II) chloride	II indicates a charge of Fe^{+2}

The crisscross method of balancing the charge in the molecule to equal zero is still necessary.

Iron (III) chloride

(+3) + 3(+1) = 0

Fe^{+3} Cl^{-1}

$FeCl_3$

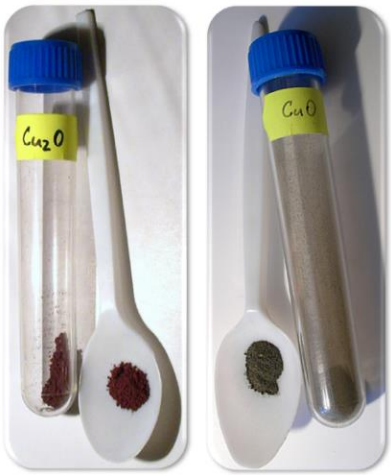
Remember that no subscript is necessary if only one atom is used.

Iron (II) chloride

(+2) + 2(-1) = 0

Fe^{+2} Cl^{-1}

$FeCl_2$



Copper oxide comes in two forms. Copper (I) oxide, the red solid to the left, and copper (II) oxide, the black solid on the right. They are different compounds because of the charge on the copper ion.

Summary

- The old system of naming compounds containing transition metals uses the Latin name with –*ic* or –*ous* ending depending on the charge on the cation.
- The newer system of naming compounds containing transition metals uses Roman numerals to indicate the amount of positive charge on the cation.

Review

1. What does the Roman numeral stand for?
2. Assign a Roman numeral to each of the following cations:
   a. Sn^{4+}
   b. Fe^{3+}
   c. Co^{2+}
   d. Pb^{4+}
3. Name the following compounds using Roman numerals:
   a. FeI_2
   b. Cr_3P_2
   c. CuCl
4. Write the formula for each of the following:
   a. Lead (IV) sulfide
   b. Cobalt (III) fluoride
   c. Chromium (II) nitride

Answers

1. The Roman numeral is the positive charge on the transition metal.
2. Assign a Roman numeral to each of the following cations:
   a. IV
   b. III
   c. II
   d. IV
3. Name the following compounds using Roman numerals:
   a. FeI_2 Iron (II) iodide
   b. Cr_3P_2 Chromium (III) phosphide
   c. CuCl Copper (I) chloride
4. Write the formula for each of the following:
   a. Lead (IV) sulfide PbS_2
   b. Cobalt (III) fluoride CoF_3
   c. Chromium (II) nitride Cr_3N_2