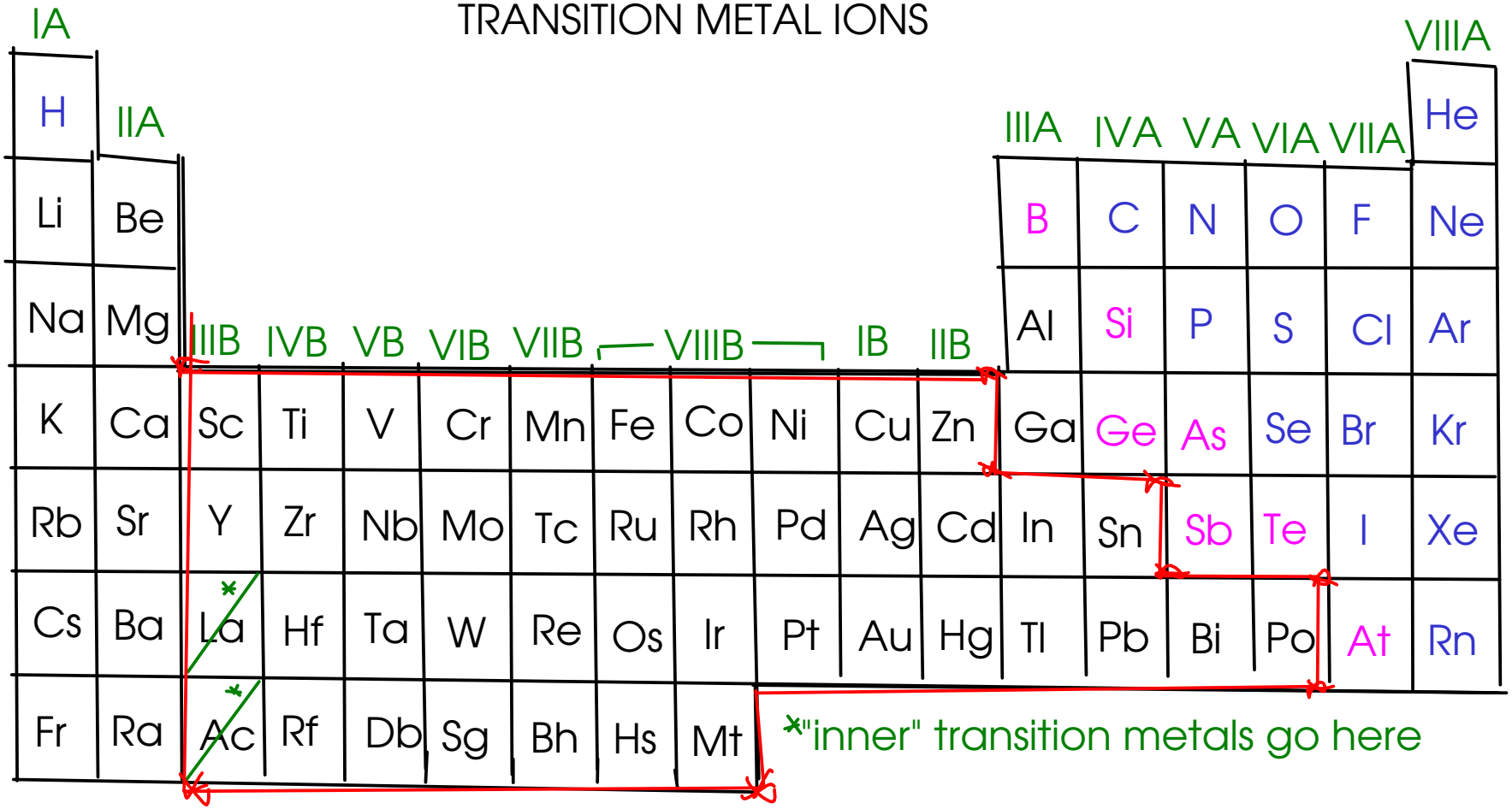
TRANSITION METAL IONS



The transition metals always form CATIONS!

However, many transition metals are capable of forming SEVERAL DIFFERENT CATIONS!

Example: Iron (Fe) forms two cations, depending on the situation: Fe^{2+} or Fe^{3+}

TRANSITION METAL CATIONS

- So how do you know which cation you're dealing with? For now, you'll have to be told

- Either the chemical formula of an ionic compound or the name of an ionic compound can tell you what charge is on the transition metal cation.

Examples:

Fe_3N_2

Fe^{2+} N^{3-}

Fe^{2+} N^{3-}

Fe^{2+}

$+6 \quad -6$

* The charge on iron ions in this compound is +2, and we call the form of iron here "iron(II)" ... pronounced "iron two". The compound as a whole is called "iron(II) nitride".

FeN

Fe^{3+} N^{3-}

$+3 \quad -3$

* The charge on iron ions in this compound is +3, and we call the form of iron here "iron(III)" ... pronounced "iron three". The compound as a whole is called "iron(III) nitride".

POLYATOMIC IONS

- Some MOLECULES can gain or lose electrons to form CATIONS or ANIONS. These are called POLYATOMIC IONS

- Polyatomic ions form ionic compounds in the same way that single-element ions do.

Example: CO_3^{2-} : CARBONATE ION

*Compare to Al_2O_3

From Al^{3+} O^{2-}

Al^{3+} CO_3^{2-}

Al^{3+} CO_3^{2-}

CO_3^{2-}

$Al_2(CO_3)_3$

* Use parenthesis when an ionic compound's formula contains more than one of a polyatomic ion.

See the web site or page 63 - table 2.5 (9th ed) or table 2.6 (10th ed) - for a list of common polyatomic ions! p64

NAMES OF IONS

- To properly discuss ions and ionic compounds, we have to know how to name them!

CATIONS

3 kinds:

1. Main group cations (metals that take only one charge when forming ions)

   - The element's name is the same as the ion's name!

   Mg^{2+}: "magnesium ion"

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2. Transition metal cations (from metals that can form several cations)

   - The CHARGE of the cation must be given. Use a ROMAN NUMERAL after the element name to indicate charge!

   Fe^{2+}: "iron(II) ion"

   Cu^{+}: "copper(I) ion"

   Fe^{3+}: "Iron(III) ion"

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3. Polyatomic cations

   - Memorize list.

   NH_4^{+}: "ammonium ion"

ANIONS

2 kinds

1. Main-group nonmetals

- Use the STEM NAME of the element, then add "-ide" suffix

N^{3-} : "nitride" ion P^{3-} : "phosphide ion" S^{2-}: sulfide ion

O^{2-} : "oxide ion" F^{-} : "fluoride ion"

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2. Polyatomic ions

- Memorize list.(see web site)

$C_2H_3O_2^{-}$: "acetate ion" SO_4^{2-} : "sulfate ion"

NO_3^{-} : "nitrate ion" SO_3^{2-} "sulfite ion"

NO_2^{-} : "nitrite ion"

* Polyatomic ions ending in "-ate" and "-ite" suffixes always contain oxygen! "-ate" ions have more oxygen atoms than their "-ite" counterparts.

NAMING IONIC COMPOUNDS

- The name of the compound is based on the name of the ions in the compound
- Cation first, anion second

Examples:

$Mg(OH)_2$

magnesium hydroxide

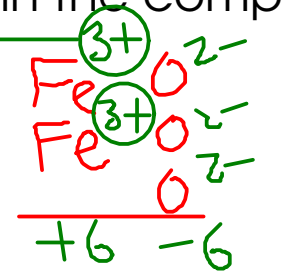
Na_2S

sodium sulfide

$BeBr_2$

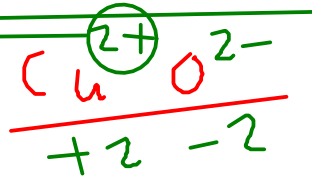
beryllium bromide

Fe_2O_3



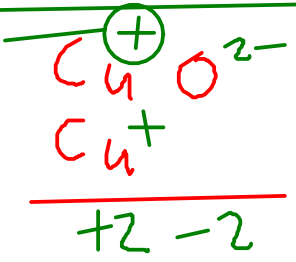
iron(III) oxide

CuO



copper(II) oxide

Cu_2O



copper(I) oxide

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* Remember to include the Roman numeral for CHARGE when you're writing transition metal compound names!

Page 63 (9th edition): Chart of polyatomic ions
Page 64 (10th edition)

NAMING IONIC COMPOUNDS

$(NH_4)_2S$

ammonium sulfide

$FeCO_3$ Fe^{2+} CO_3^{2-}

iron(II) carbonate

TiS_2 Ti^{4+} S^{2-} S^{2-} $+4 \quad -4$

titanium(IV) sulfide

$Ba_3(PO_4)_2$

barium phosphate

Spelling matters!

Ba_3P_2

barium phosphide

DETERMINING THE FORMULA OF AN IONIC COMPOUND FROM THE NAME

- The name of an ionic compound is made of the names of the CATION and ANION in the compound.

- To get the FORMULA, you must figure out the SMALLEST RATIO of cation to anion that makes the charges balance out

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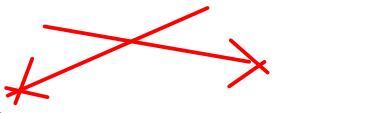
Examples:

iron(III) carbonate

Fe^{3+} CO_3^{2-}



$Fe_2(CO_3)_3$

potassium sulfide

K^+ S^{2-}

K^+

K_2S

calcium bromide

Ca^{2+} Br^-

Br^-

$CaBr_2$