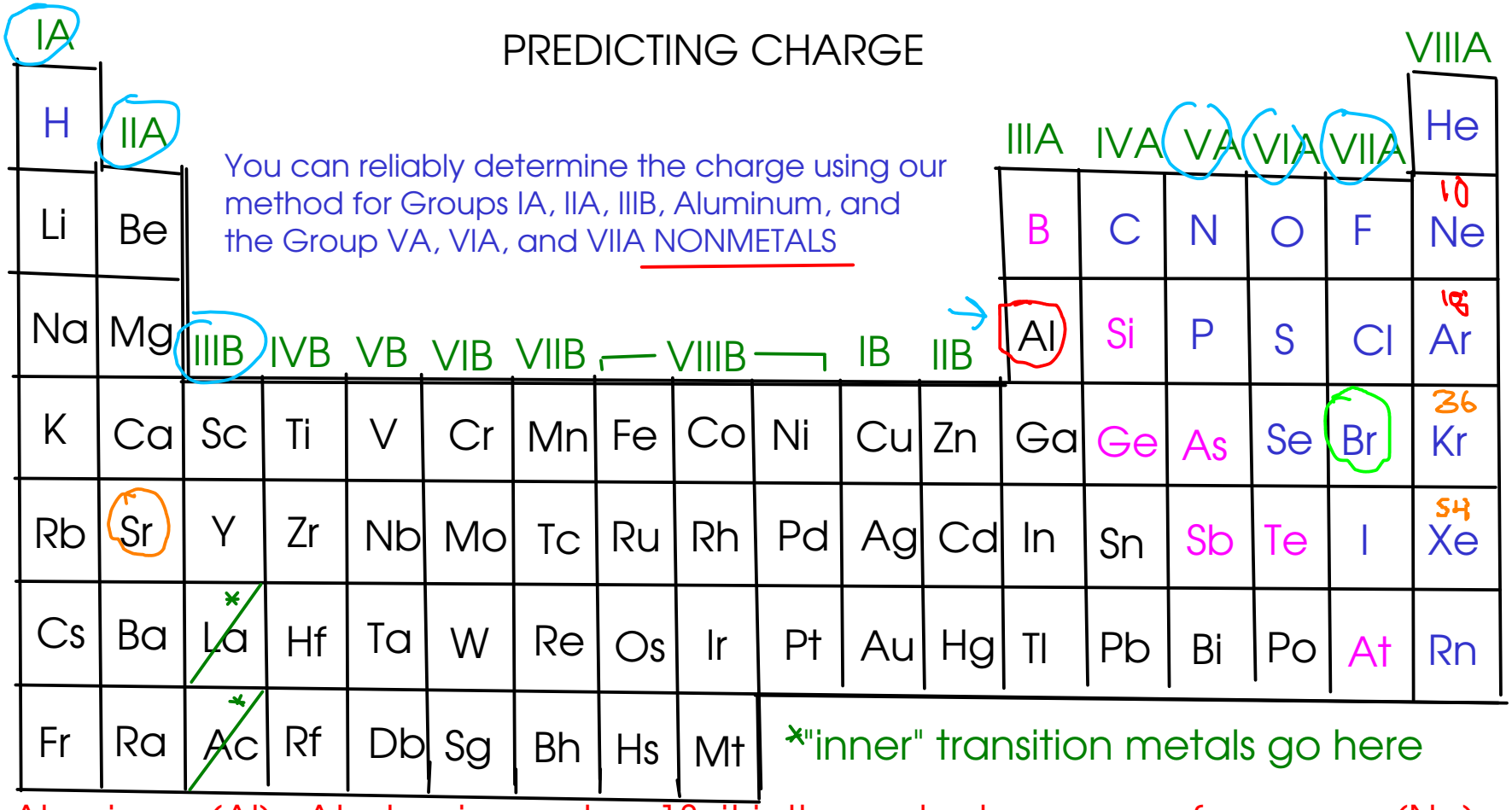
PREDICTING CHARGE



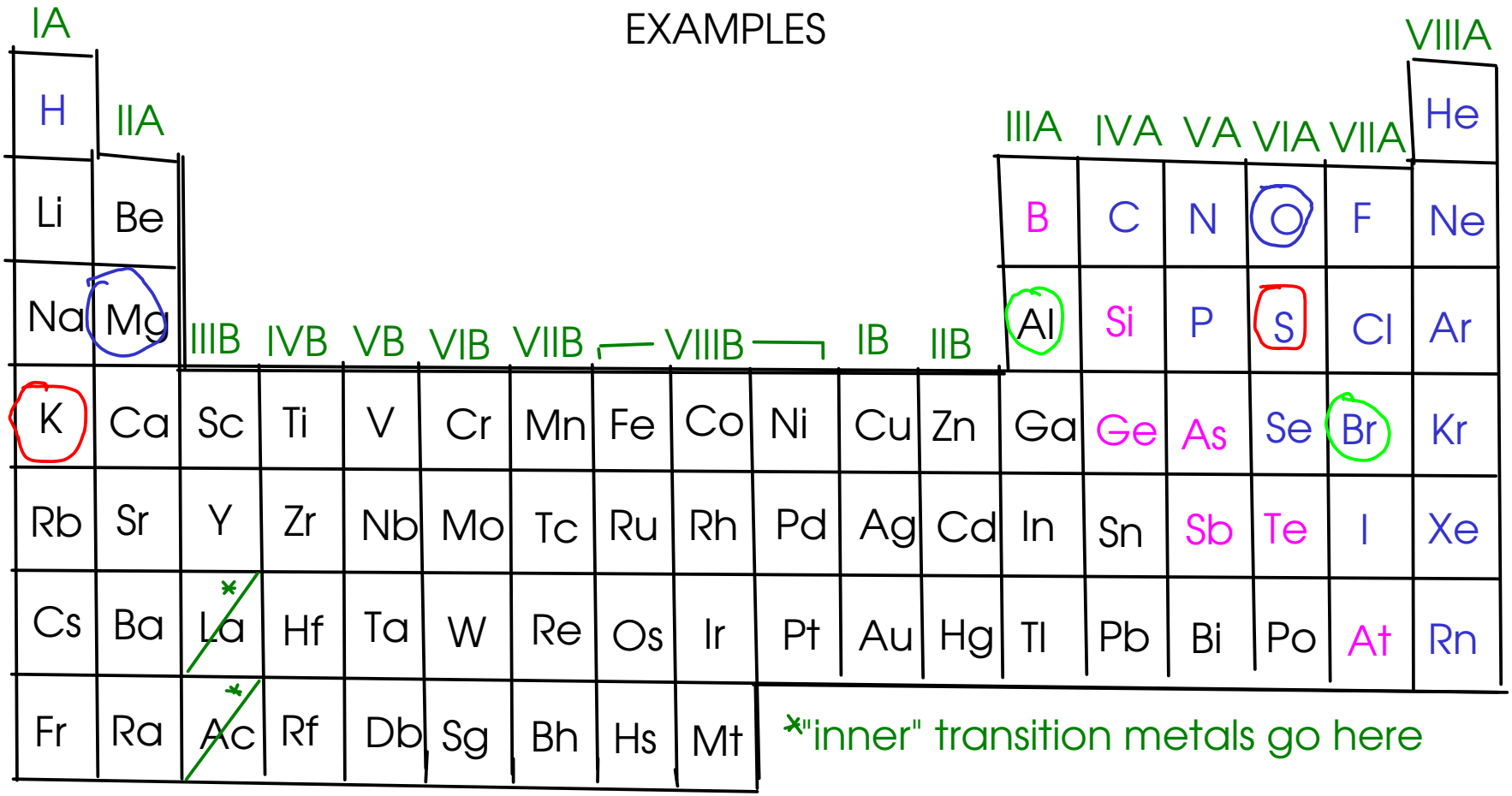
You can reliably determine the charge using our method for Groups IA, IIA, IIIB, Aluminum, and the Group VA, VIA, and VIIA NONMETALS

Aluminum (Al): At atomic number 13, it is three electrons away from neon (Ne), and 5 electrons away from argon (Ar). Prediction: Aluminum will lose three electrons to form the cation Al^{3+}

Bromine (Br): At atomic number 35, bromine is one electron away from krypton (Kr). Prediction: Bromine will gain one electron to form the anion Br^-

Strontium (Sr): At atomic number 38, strontium is two electrons away from krypton. Prediction: Strontium will lose two electrons to form the cation Sr^{2+}

EXAMPLES



Find the formulas of:

(1) an ionic compound containing Al and Br

(2) an ionic compound containing Mg and O

(3) an ionic compound containing S and K

Al^{3+} Br^{-}

Mg^{2+} O^{2-}

S^{2-} K^{+}

Find the formula of:
* an ionic compound containing Al and Br

Al^{3+} Br^-

Al^{3+} Br^- Br^- Br^-

$AlBr_3$

Find the formula of:
* an ionic compound containing Mg and O

Mg^{2+} O^{2-} ⟶ MgO

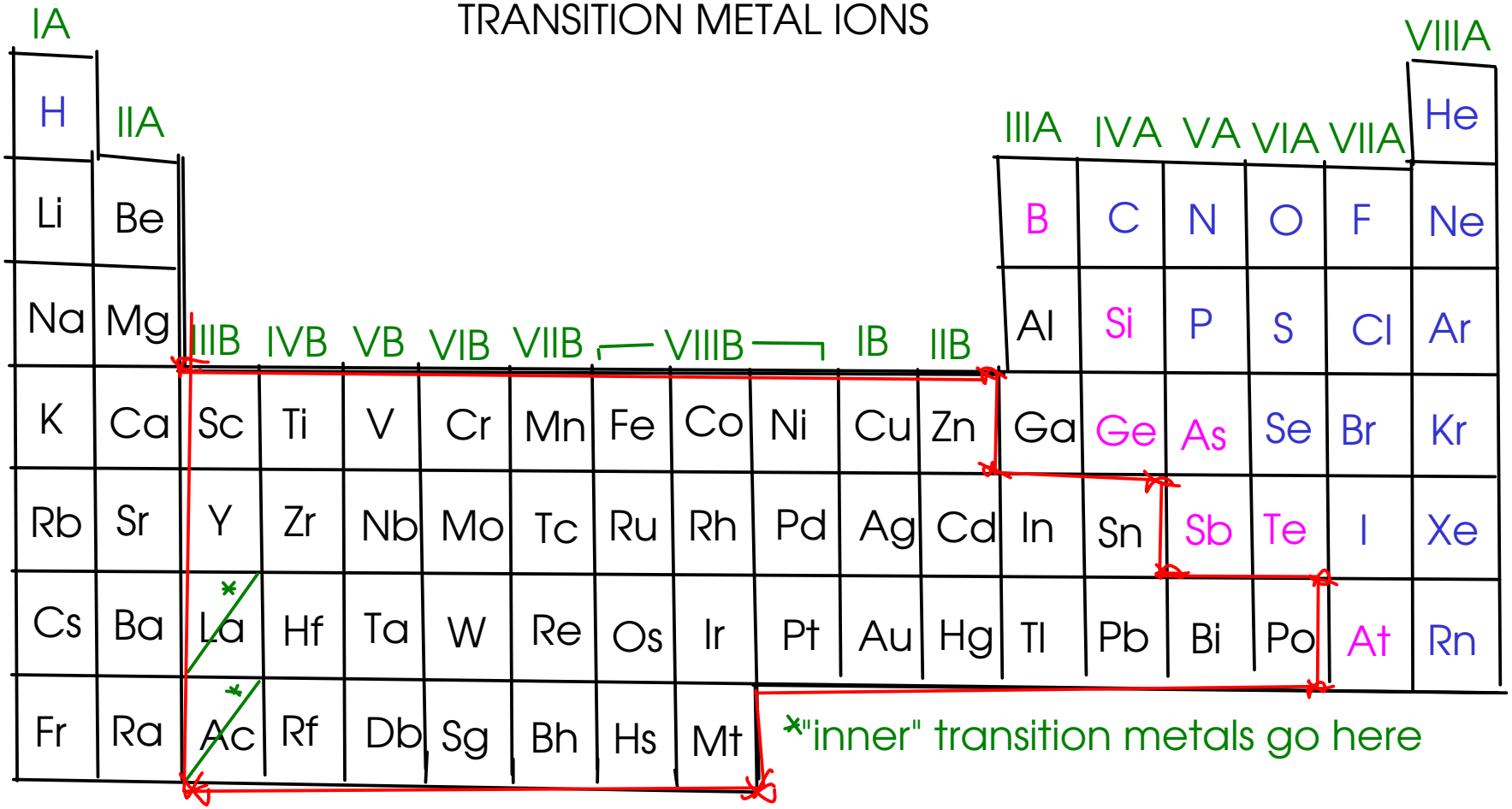
Find the formula of:
* an ionic compound containing S and K

S^{2-} K^+

S^{2-} K^+ K^+

Reminder: When writing an ionic formula, make sure to write the cation (+) first ----------> K_2S

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+}

$+6\quad -6$

* This compound contains iron ions with a charge of +2. This form of iron ion is called "iron(II)", pronounced "iron two". The compound is called "iron(II) nitride".

FeN

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

$+3\quad -3$

* This compound contains iron ions with a charge of +3. This form of iron ion is called "iron(III)", pronounced "iron three". The compound 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"

---

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"

---

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"

---

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

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

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

O^{2-}

+6 −6

iron(III) oxide

CuO

Cu^{2+} O^{2-}

+2 −2

copper(II) oxide

Cu_2O

Cu^{+} O^{2-}

Cu^{+}

+2 −2

copper(I) oxide

* 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-}

$+4$ -4

titanium(IV) sulfide

$Ba_3(PO_4)_2$

barium phosphate

Ba_3P_2

Spelling matters!

barium phosphide