WRITING AN IONIC FORMULA

- if you know the ions that make up a compound, all you need to do is find the smallest ratio of cation to anion the compound needs to have an overall charge of zero

Example: Mg^{2+}, P^{3-} ... what is formula?

Mg^{2+}

P^{3-} ← more − than +, so add more Mg^{2+}

Mg^{2+}

← more + than −, so add P^{3-}

← more − than +, so add Mg^{2+}

Mg_3P_2] In the final formula, don't write the charges on the ions!

* Remember, ionic compounds are written with the SMALLEST whole-number ratio!

Ionic formulas are ALWAYS written with the cation first, and the anion second!

Cross method: Mg^{2+} P^{3-} → Mg_3P_2

More examples:

Ca^{2+} F^-

Ca^{2+} F^-

F^-

CaF_2

Ti^{4+} O^{2-}

Ti^{4+} O^{2-}

O^{2-}

Ti_2O_4 → TiO_2

K^+ N^{3-}

K^+ N^{3-}

K^+

K^+

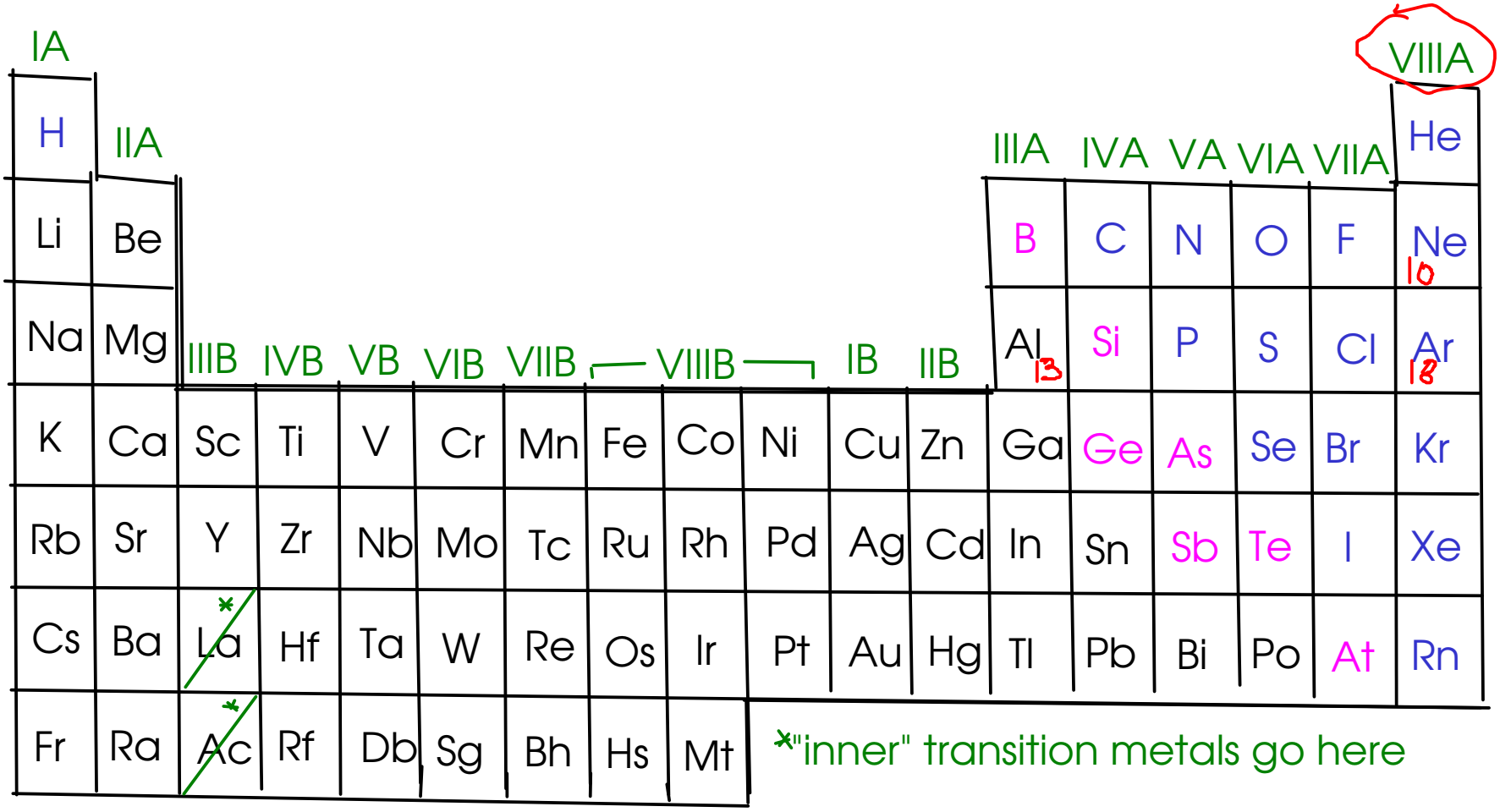
K_3N

You can also use the "cross method", as described in your textbook, to write formulas. Use caution, as the "cross method" will sometimes give you the wrong formula! It would give you the wrong answer for this one!

PREDICTING CHARGES

- how do you figure out the charge that an element might take when it becomes an ion?

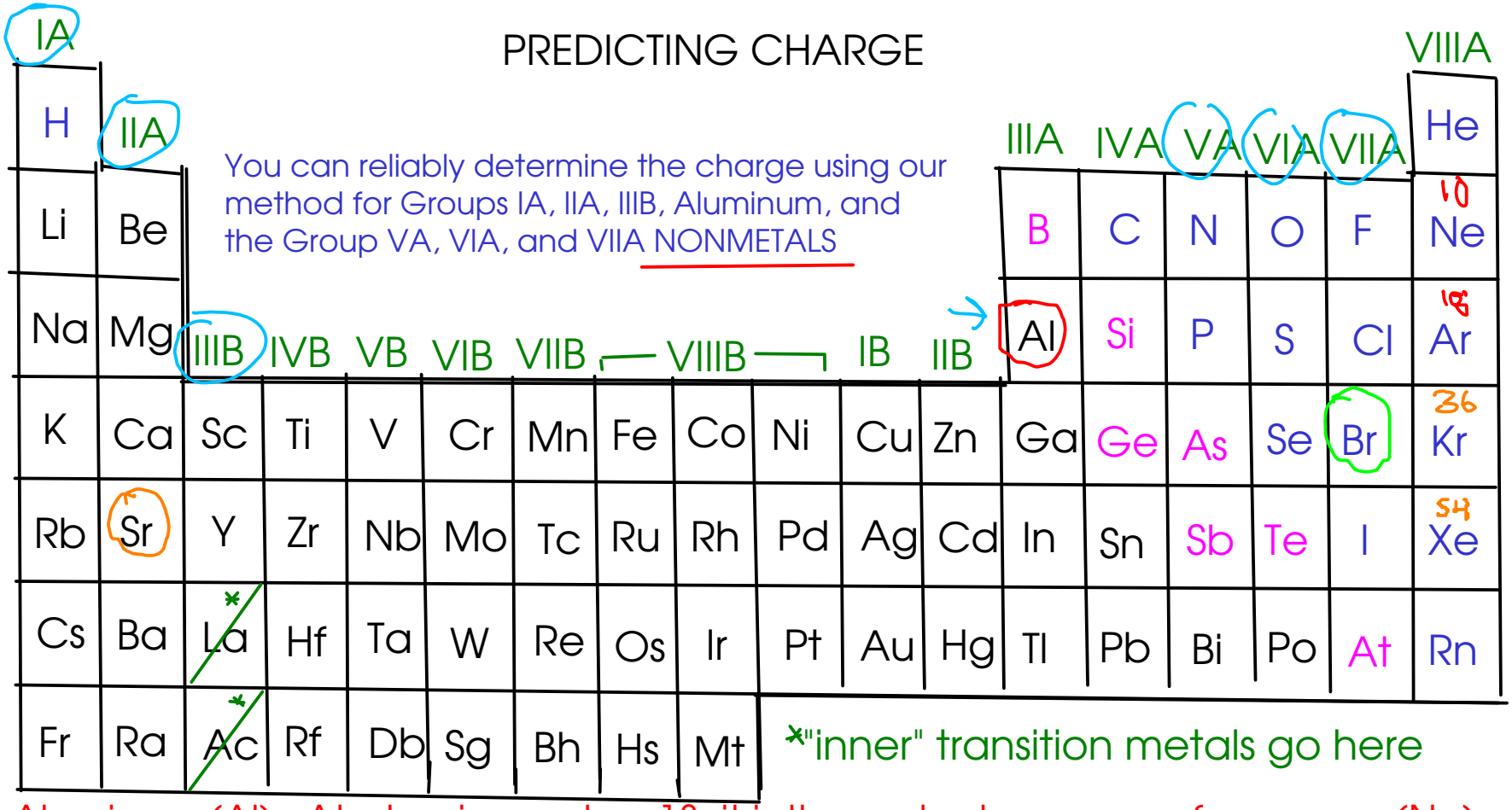
- for many main group elements, you cah predict the charge using the periodic table!



Elements in group VIIIA - the "noble gases" - do not form ions!

Many OTHER main-group elements form either anions or cations that have the same overall number of electrons as the NEAREST (in terms of atomic number) noble gas!

PREDICTING CHARGE



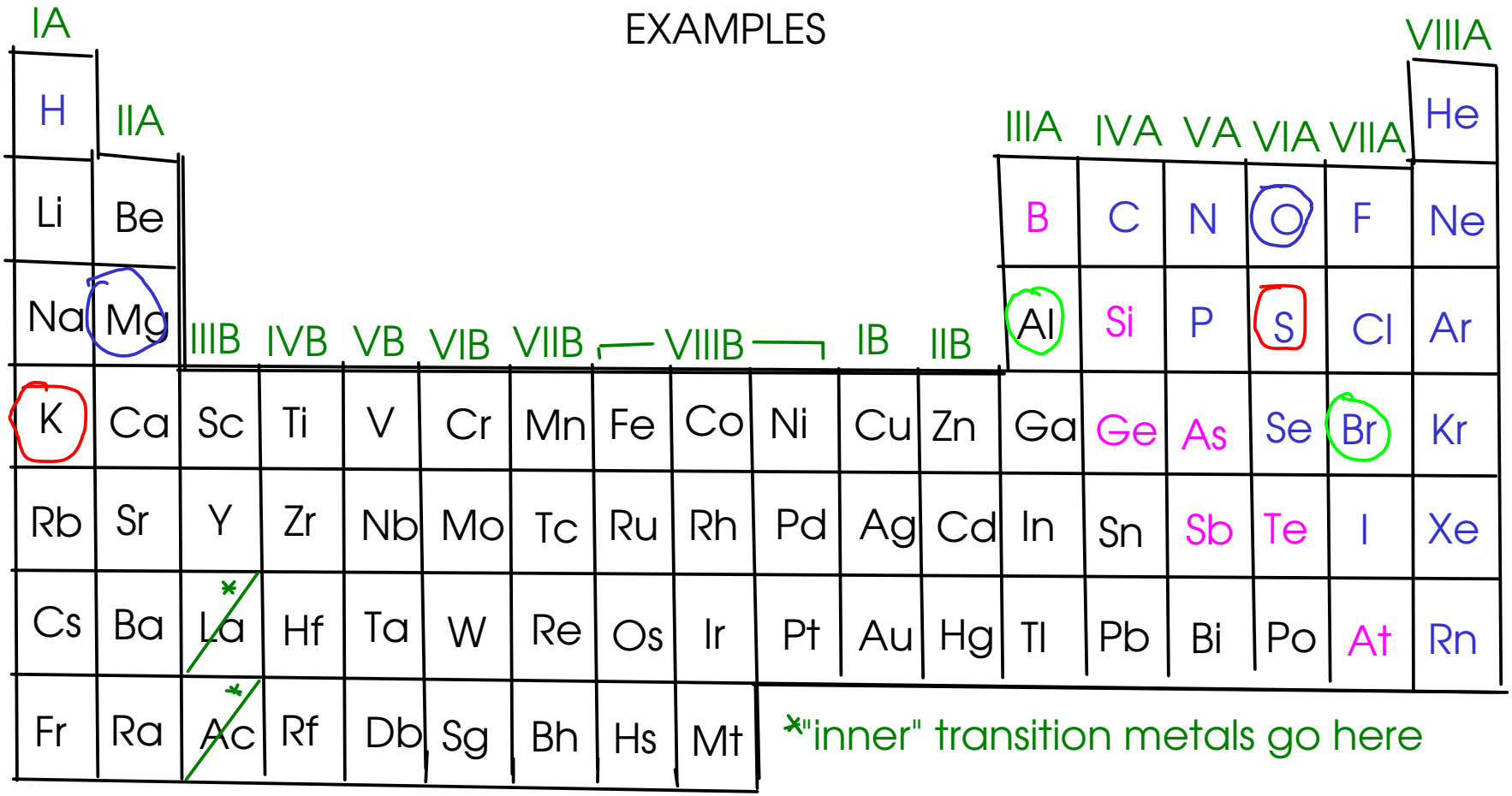
You can reliably determine the charge using our method for Groups IA, IIA, IIIB, Aluminum, and the Group VA, VIA, and VIIA NONMETALS

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^- $AlBr_3$

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

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

MgO

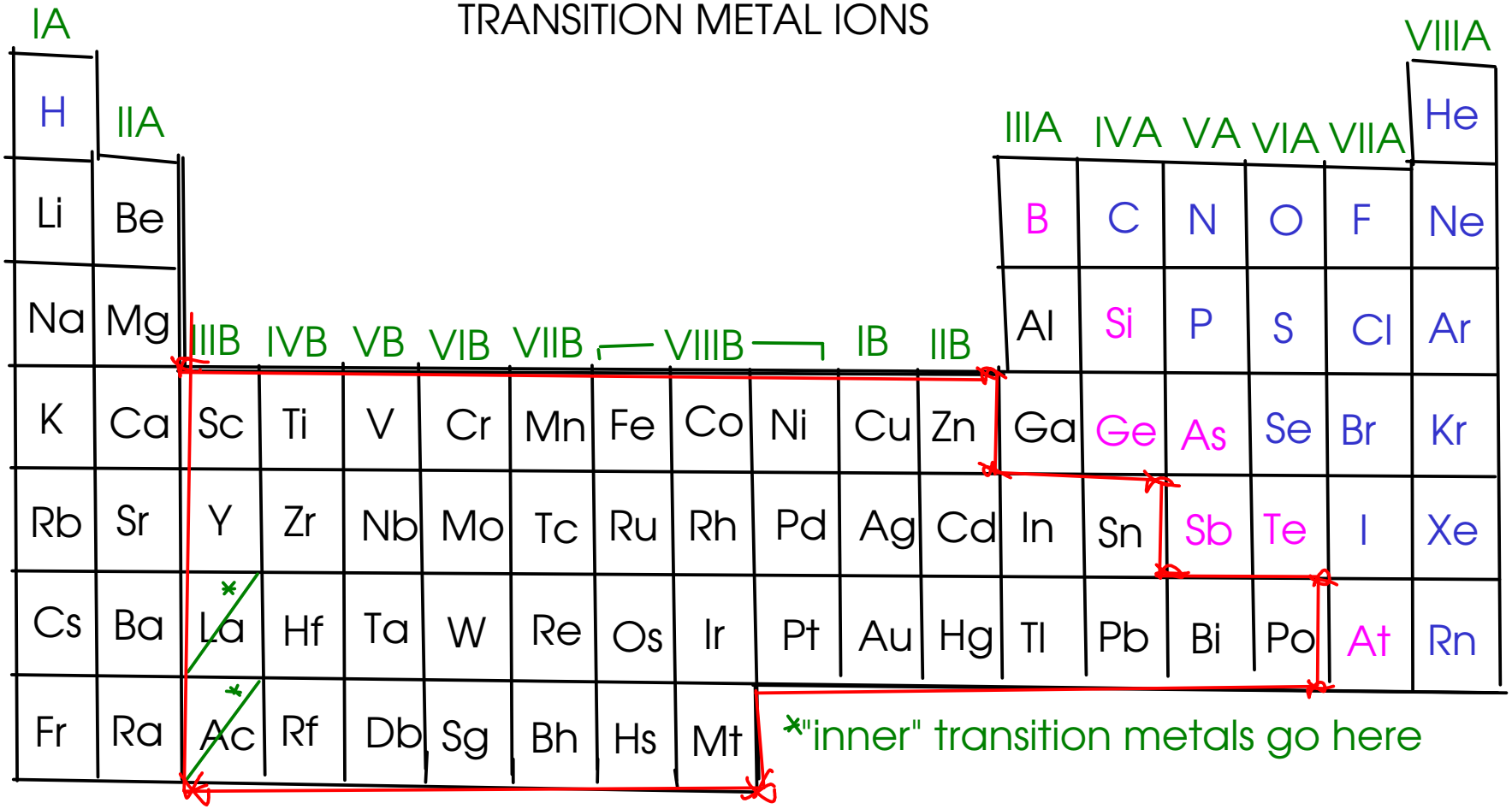
Find the formula of:
* an ionic compound containing S and K

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

K_2S

For ionic formulas, remember to write the cation (+ charge) first! ---------->

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 +2 charge.
We call them "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 +3 charge.
We call them "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 Openstax page 100 - table 2.5 for a list of common polyatomic ions!