

# TRANSITION METAL IONS

IA		TRANSITION METAL IONS										VIII A					
H	IIA											III A	IV A	V A	VIA	VII A	He
Li	Be											B	C	N	O	F	Ne
Na	Mg	IIIB	IVB	VB	VIB	VII B	VIII B	IB	IIB								
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	*La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	*Ac	Rf	Db	Sg	Bh	Hs	Mt	*"inner" transition metals go here								

The transition metals always form CATIONS!

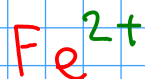
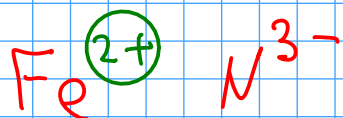
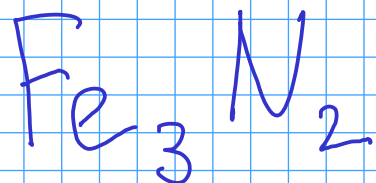
However, many transition metals are capable of forming SEVERAL DIFFERENT CATIONS!

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

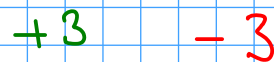
## TRANSITION METAL CATIONS

- 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:



\* We call this form of iron ion "iron(II)"!



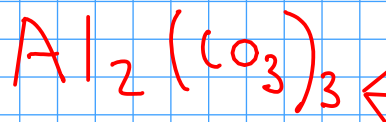
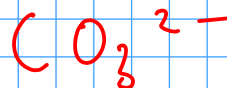
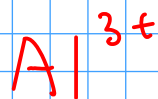
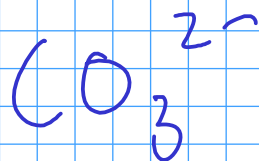
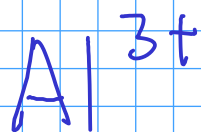
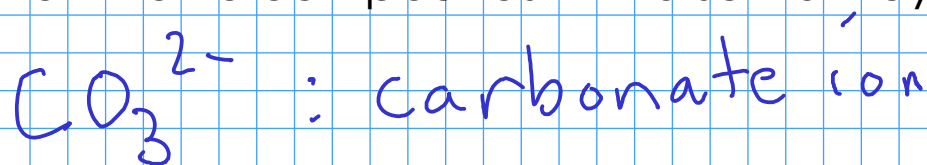
\* We call this form of iron ion "iron(III)"!

## 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:



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

YOU MUST MEMORIZE THE NAMES AND FORMULAS OF THE MOST COMMON POLYATOMIC IONS. CHECK THE COURSE WEB SITE FOR A LIST!

## 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!



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!



③ Polyatomic cations

- Memorize list.



# ANIONS

2 kinds

1

Main-group nonmetals

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

$\text{N}^{3-}$  : "nitride" ion

$\text{P}^{3-}$  : "phosphide" ion

$\text{S}^{2-}$  : sulfide ion

$\text{O}^{2-}$  : "oxide" ion

$\text{F}^{-}$  : "fluoride" ion

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2.

Polyatomic ions

- Memorize list. (see web site)

$\text{C}_2\text{H}_3\text{O}_2^{-}$  : "acetate ion"

$\text{SO}_4^{2-}$  : "sulfate" ion

$\text{NO}_3^{-}$  : "nitrate ion"

$\text{SO}_3^{2-}$  "sulfite" ion

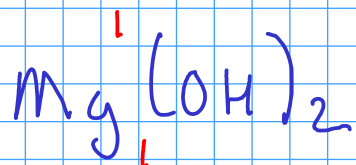
$\text{NO}_2^{-}$  : "nitrite ion"

\* 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:



magnesium hydroxide

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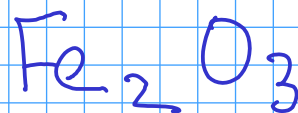


sodium sulfide

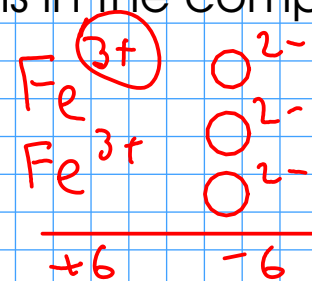
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beryllium bromide



iron(III) oxide

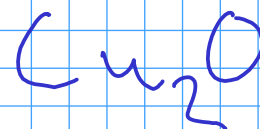
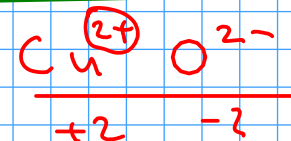


"iron oxide" isn't a complete name. There are several different iron oxides!

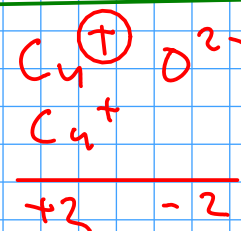
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copper(II) oxide

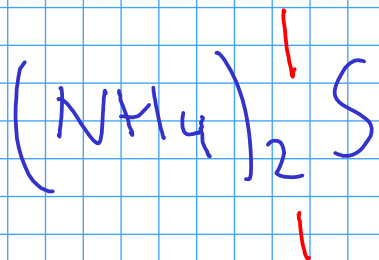


copper(I) oxide

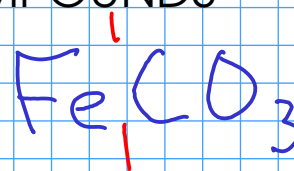


Remember to include the Roman numeral for CHARGE in the name of transition metal compounds!

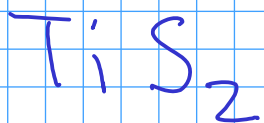
# NAMING IONIC COMPOUNDS



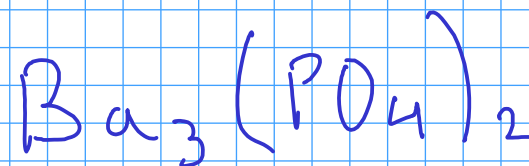
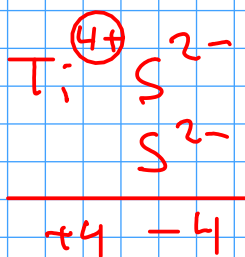
ammonium sulfide



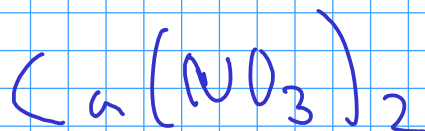
iron(II) carbonate



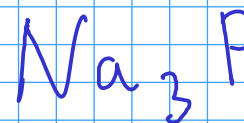
titanium(IV) sulfide



barium phosphate



calcium nitrate



sodium phosphide

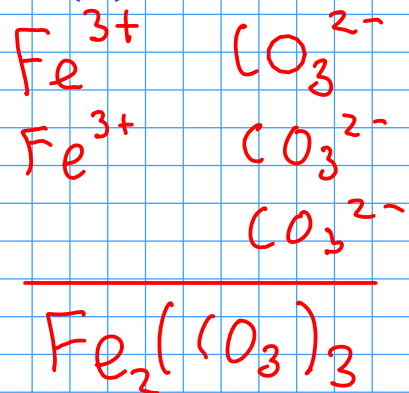
Spelling matters!

## DETERMINING THE FORMULA OF AN IONIC COMPOUND FROM THE NAME

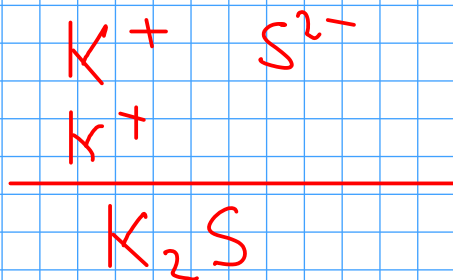
- The name of an ionic compound is made of the names of the CATION and ANION in the compound.
  - To get the FORMULA, you must figure out the SMALLEST RATIO of cation to anion that makes the charges balance out
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Examples:

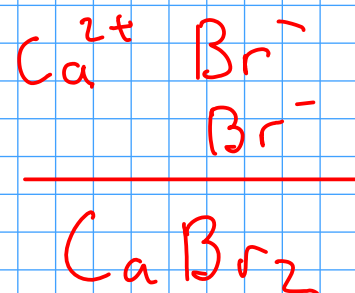
iron(III) carbonate



potassium sulfide



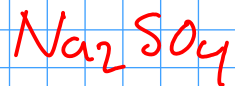
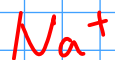
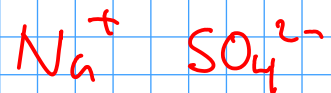
calcium bromide



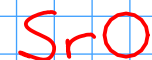
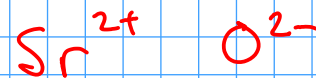


## DETERMINING IONIC FORMULAS

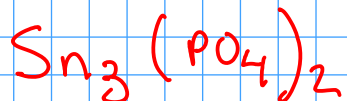
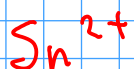
sodium sulfate



strontium oxide



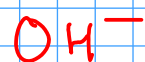
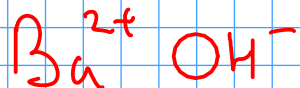
tin(II) phosphate



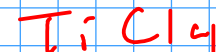
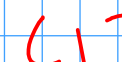
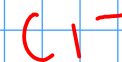
chromium(III) nitrate



barium hydroxide



titanium(IV) chloride



Don't forget the parenthesis when you have more than one hydroxide ion!