Sc9 Notes Chem Unit Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**MULTI-VALENT COMPOUNDS + POLYATOMIC IONS**

**MULTI-VALENT METAL COMPOUNDS**

* Many important metals are **multivalent**
  + “multi” means *many*
  + “valent” refers to the *capacity to bond*
* Multivalent metals can form \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ different \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ions with different ion charges
  + *Ex:* **Iron** has 2 ion charges: **\_\_\_\_\_\_\_\_\_\_** and **\_\_\_\_\_\_\_\_\_\_**. It can exist as either.
* Periodic table shows the most **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** ion charge first
* Text

  Description automatically generatedWhen we’re talking about **multivalent metals (ONLY!)**, we need make sure we’re clear ***which   
  ion*** form we’re talking about. To do this, we use **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  + We \_\_\_\_\_\_\_\_\_\_\_\_\_\_ use Roman Numerals for copper (Cu) because it can have a charge   
    of either 2+ or 1+ as an ion, and we’d need to specify which one
  + Text

    Description automatically generated*Table

    Description automatically generated*We \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ use Roman Numerals for calcium (Ca) because it always has a   
    charge of 2+ as an ion

*Examples*

Fe3+ - Written: **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** ; pronounced : “iron three” ; means the iron ion has a charge of 3+

Fe2+ - Written: **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** ; pronounced : “iron two” and means the iron ion has a charge of 2+

Pb4+ - Written: **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** ; pronounced : “lead four” and means the lead ion has a charge of 4+

Cu+ - Written: **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** ; pronounced : “copper one” and means the copper ion has a charge of 1+

**Writing Chemical Formulas with Multivalent Metals**

* The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ after the metal will tell you which ion charge to use
  + Example: chromium(III) fluoride 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***Examples*: Write the chemical formulas of the following compounds**

|  |  |
| --- | --- |
| * copper(I) iodide 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ * tin(II) nitride 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | * iron(II) phosphide 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_ * tin(IV) nitride 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

**Naming Compounds with Multivalent Metals**

* It’s important EVERY time you write the metal in the compound, you stop to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ if it’s multivalent!!
  + If it **IS**, you need to include the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  + If it **IS NOT** multivalent, **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** include Roman Numeral!

**Examples: Write the name of the following compounds**

|  |
| --- |
| * Cu3P 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ * MnO2  🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

**POLYATOMIC IONS**

* It is possible for some **molecules** (i.e. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ) to gain or lose electrons (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **bonding**) as their atoms combine to form a molecule(\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **bonding**)
* In doing so, they become a ***molecular ion***, called a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Chart, diagram

Description automatically generated

***Example: Breathalyzer tests***

In one type of Breathalyzer test, an orange liquid (potassium dichromate) turns green in the presence of alcohol.

* A picture containing chart

  Description automatically generatedChart, bubble chart

  Description automatically generatedPotassium dichromate contains **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** & **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  1. A picture containing chart

     Description automatically generatedDichromate ion has the formula **Cr2O72-**
  2. **\_\_\_\_\_** atoms of chromium & **\_\_\_\_** atoms of oxygen; has a charge of **\_\_\_\_\_\_**
  3. The atoms ***oxygen*** and ***chromium*** are connected by **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** bonds to make ***dichromate***
  4. The negatively charged ***dichromate ion*** is connected by **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** bonds to positive ***potassium ions*** in the ***potassium dichromate***.
* We just learned that some ***molecules*** can **\_\_\_\_\_\_\_\_\_\_\_\_\_** or **\_\_\_\_\_\_\_\_\_\_\_\_\_** electrons to become **polyatomic ions**
* Because a polyatomic ion carries an electric charge, it **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** exist on its own. It is always paired up with ions that carry an **opposite** charge.
* Polyatomic ions often have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ names, so if you do not see the word listed as an element on the periodic table, chances are it is a polyatomic ion so refer to the table of common polyatomic ions

**Part A: Writing Formulas of Compounds with Polyatomic Ions**

*Examples*:

Sodium chromate Tin(II) hydroxide

**Part B: Naming Compounds with Polyatomic Ions**

*Examples*:

NaCH3COO Cr(OH)3 Ba3(PO3)2