CH 151 Summer 2024:
"Nomenclature" *(online)*
Lab - Instructions

Step One:

Watch the lab video for the "Nomenclature" lab, found here:
http://mhchem.org/t/h.htm
There is no data to record in this lab video.

Step Two:

Complete pages Ib-3-5 through Ib-3-8 using the "Nomenclature" video and the actual lab instructions on pages Ib-3-3 through Ib-3-4. Include your name on page Ib-3-5!

Step Three:

Submit your lab (pages Ib-3-5 through Ib-3-8 *only* to avoid a point penalty**) as a *single* PDF file to the instructor via email (mike.russell@mhcc.edu) on Wednesday, July 3 by 11:59 PM.** I recommend a free program (ex: CamScanner, https://camscanner.com) or a website (ex: CombinePDF, https://combinepdf.com) to convert your work to a PDF file.

If you have any questions regarding this assignment, please email (mike.russell@mhcc.edu) the instructor! Good luck on this assignment!

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Nomenclature: The Language of Chemistry

Systematic chemical names of inorganic compounds were developed by a group of scientists who were part of the International Union of Pure and Applied Chemistry (IUPAC) which first met in 1921. Elements are represented by symbols which are the first, first two, or first and third letters from the name of the element. There are some notable exceptions, where the symbols appear to have no connection to the name of the element. These symbols are derived from early names for these elements. The table below illustrates some of these.

Present Name	Symbol	Former Name
Antimony	Sb	Stibium
Copper	Cu	Cuprum
Gold	Au	Aurum
Iron	Fe	Ferrum
Lead	Pb	Plumbum
Potassium	K	Kalium
Silver	Ag	Argentum
Sodium	Na	Natrium
Tin	Sn	Stanum
Tungsten	W	Wolfram

The names of inorganic compounds are constructed so that every compound can be named from its formula and each formula has a name unique to that formula. For the purpose of clarity, we will divide the formulas into the following categories:

1) Binary compounds of nonmetals (covalent molecules)
2) Binary compounds of a metal and nonmetal (ionic compounds)
3) Ternary and higher compounds (polyatomic ions and acids)

I. Binary Covalent Compounds: two nonmetals

1. Name first element, preceded by Greek prefix for number of atoms. If one, omit mono.
2. Name the second element, preceded by Greek prefix for number of atoms even if one.

The ending of the second element is -ide.

Greek Prefixes: 1 = mono 2 = di 3 = tri 4 = tetra 5 = penta
6 = hexa 7 = hepta 8 = octa 9 = nona 10 = deca

Examples:	Formula	Name
	PCl_3	Phosphorous trichloride
	SO_2	Sulfur dioxide
	CO	Carbon monoxide
	N_2O	Dinitrogen monoxide

II. Ionic Compounds: metal + nonmetal - A. Metal with a fixed charge

1. Name metal (cation) first - **only** for metals in Groups IA, IIA and the "stairs"
2. Name nonmetal (anion) with the ending changed to -ide. Charge = **group number - 8**

Ex:	Formula	Name	**Fixed Charge Cations**
	KCl	Potassium chloride	IA = +1
	Na_2S	Sodium sulfide	IIA = +2
	Al_2S_3	Aluminum sulfide	IIIA = +3 one of the 'stairs' (*video*)

In ionic compounds, the metal and nonmetal must combine in a ratio to give an overall neutral charge. To write formulas based on name, first write the symbol with the correct charge for the cation and anion. Then determine the lowest ratio for a neutral compound.

B. Metals with variable charge (transition metals, lanthanides, actinides, etc.)

1. Name metal. In parentheses write the charge of the metal in Roman numerals.
   The charge is determined based on the fixed charge of the nonmetal.
   [Fixed charges of nonmetal: VIIA = -1; VIA = -2; VA = -3]
2. Name nonmetal with the ending -ide. Charge = **group number - 8**

Examples:	Formula	Name	Old Method – ***do NOT use!***
	CuCl	Copper(I) chloride	*Cuprous chloride*
	$CuCl_2$	Copper(II) chloride	*Cupric chloride*
	FeO	Iron(II) oxide	*Ferrous oxide*
	Fe_2O_3	Iron(III) oxide	*Ferric oxide*

III. Polyatomic Anions and Acids

When writing names of ionic compounds composed of polyatomic anions or of acids, you must first learn the name, number of oxygens, and charge of the most common polyatomics (listed below). Then add the following rules for naming polyatomics and acids with differing number of oxygens. Notice that as oxygens are added/ subtracted, the polyatomic charge remains the same. **Common polyatomic ions** include:

CO_3^{-2}	carbonate	ClO_3^{-1}	chlorate	OH^{-1}	hydroxide
NO_3^{-1}	nitrate	BrO_3^{-1}	bromate	NH_4^{+1}	ammonium
PO_4^{-3}	phosphate	IO_3^{-1}	iodate	HCO_3^{-1}	bicarbonate
SO_4^{-2}	sulfate	MnO_4^{-1}	permanganate	$Cr_2O_7^{2-}$	dichromate

$C_2H_3O_2^{-1}$ - acetate

# Oxygens	***Anion***	***Example***	***Acid***	***Example***
+1 Oxygen	per-ate	perchlorate, ClO_4^-	per-ic	perchloric acid, $HClO_4$
common	-ate	chlorate, ClO_3^-	-ic	chloric acid, $HClO_3$
-1 Oxygen	-ite	chlorite, ClO_2^-	-ous	chlorous acid, $HClO_2$
-2 Oxygen	hypo-ite	hypochlorite, ClO	hypo-ous	hypochlorous acid, HClO
No Oxygen	-ide	chloride, Cl	hydro-ic	hydrochloric acid, HCl

For more polyatomic / acid help, see the "**Common Polyatomic Ions and the Corresponding Acids**" handout in your lab manual under "Learning Resources"

Nomenclature (online) **Lab** **Name:**

1a. Ionic Compounds (metal + nonmetal)

	FORMULA	**CATION**	**ANION**	**NAME**
Ex.	$CaBr_2$	Ca^{2+}	Br^{1-}	Calcium bromide
1				**Magnesium nitride**
2		**K^+**	**S^{2-}**	
3	**ZnO**			
4		**Sn^{4+}**	**O^{2-}**	
5	**Cr_2S_3**			
6				**Copper(I) phosphide**
7	**RbI**			
8				**Calcium nitride**
9				**Titanium(IV) chloride**
10	**SrS**			
11	**Au_2O_3**			
12				**Cadmium phosphide**

1b. Covalent Compounds (nonmetal + nonmetal)

1. SF_6 _____
2. IBr _____
3. _____ Carbon monoxide
4. _____ Dinitrogen pentoxide

2. Name the following: (Hint: First identify if the compound is ionic or covalent)

a. NaF

b. PbS

c. TiO_2

d. Cr_2O_3

e. Zn_3P_2

f. MnO_2

g. PI_3

h. S_2Br_2

i. IBr_5

j. XeF_4

3. Write formulas for the following compounds: (See hint above!)

a. Barium iodide

b. Palladium(II) bromide

c. Zinc arsenide

d. Gold(III) oxide

e. Lead(IV) oxide

f. Copper(I) sulfide

g. Sulfur hexafluoride

h. Nitrogen trichloride

i. Chlorine dioxide

Nomenclature (online) Lab
Polyatomic Anions and Acids

4. Write the names for the following compounds. If the compound is an **acid**, name as an acid and not an ionic compound to receive full credit.

a. Na_2SO_4

b. $Ca(ClO)_2$

c. $Ba(NO_3)_2$

d. $Al(OH)_3$

e. $Fe(NO_2)_3$

f. $CuSO_3$

g. Cu_2CO_3

h. NH_4ClO

i. $Ni_3(PO_4)_2$

j. $Pb(OH)_2$

l. $HBrO_3$

m. $HBrO_2$

n. HBrO

o. HBr

p. $HBrO_4$

q. H_2SO_4

r. HNO_3

s. H_3PO_3

5. Write the chemical formulas for the following compounds.

a. sodium phosphate

b. iron(II) sulfate

c. calcium bromate

d. aluminum nitrate

e. zinc(II) sulfite

f. copper(I) chlorite

g. ammonium hydroxide

h. silver nitrite

i. lead(II) phosphate

j. potassium bicarbonate

k. iodic acid

l. hypoiodous acid

m. periodic acid

n. iodous acid

o. hydroiodic acid

p. sulfurous acid

q. nitric acid

r. nitrous acid

s. phosphoric acid

t. acetic acid

u. carbonic acid