#

***chem. 1013: Supplementary Note On Naming***

***(see also: text pp.60-69)***

## 1. NAMING BINARY MOLECULAR COMPOUNDS

Binary molecular compounds are generally formed from two non-metallic elements in the `p’ block of the Periodic Table, and/or with H. [In,Sm,Tl,Pb,Bi & Po are sufficiently metal-like that they are considered metals rather than non-metallic elements.]

H

 metals p block (non metals)

The sense that elements combined from these regions

are `molecular’ arises from the general-though not

all –inclusive observation that many of the binary

compounds formed from elements in the p block

have smilar desires for electrons, e.g. they have

an electronegativity difference < 1.9, e.g.

they are polar covalent or covalent.

*inert gases*

In.Sn

Tl,Pb,Bi,Po

Naming binary molecular compounds is relatively easy.

 Some examples should give you a sense of the pattern:

formula name

mono=1 hexa=6

di=2 hepta=7

tri=3 octa=8

tetra=4 nona=9

penta=5 deca=10

H2O ***di***hydrogen monox**ide**

H­­­2O2 ***di***hydrogen ***di***ox**ide** PREFIX

As2O ***di***arsenic monoox**ide** LIST

P4O10 ***tetra***phosphorus decaox**ide**

In each case, the less electronegative element is listed first followed by the more electronegative element. To name the compound they form, the number of atoms of the first listed element is indicated with a specific prefix as long as its > 2 (see list above), followed by that element’s name. The second , more electronegative element’s atom count is indicated with another prefix, followed by the first 3-5 letters of the element’s name, followed by the **–ide** suffix

More examples:

 NO nitrogen monoxide (note that only second element has O count indicated by mono)

 N2S dinitrogen monosulfide

 SeO2 selenium dioxide

 P2Cl diphosphorus monochloride

 B4C3 tetraboron tricarbide

# 2. NAMING IONIC COMPOUNDS

***Ionic Compounds*** are simple combinations of ***cations*** and ***anions*** that join to form a neutral species. For simple binary combinations, an ionic compound is formed from metals and non-metals (or if the difference in the element electronegativities is > 1.9…see pp 64-5.)

***Cations*** are generally transition or non transition metals e.g. Fe3+ or Na+ …..**or H+**

***Anions*** are generally `p’ block elements or polyatomic combinations (often oxyanions) e.g. Cl- or CO3 2-

Naming rules for ionic compounds depend on what class of cation is being combined. Since there are 3 different classifications of cations, there are three different naming systems. (The polyatomic anions are treated identically to single element anions.)

 **ANION**

 **single element polyatomic**

 **non transition *sodium chloride*  *sodium carbonate***

#### C

**A**

**T**

**I**

**O**

**N**

 **METAL NaCl Na2CO3**

 **transition *iron (III) chloride* *iron (III) carbonate***

 **METAL or or *ferric chloride*  *ferric carbonate***

**FeCl3 Fe­2 (CO3**)3

 **H hydrogen chloride (gas) hydrogen carbonate (gas)**

 **hydrochloric acid (aqueous) carbonic acid (aqueous)**

 **HCl H2CO3**

3. PATTERNS IN NAMING OF OXYANIONS

The names and details of the polyatomic anions are the most troublesome to recall accurately. However, there are some patterns that can help you remember them. For example, the simple elemental anions (carbide, nitride etc) **add** enough electrons to reach an inert gas core. Their equivalent oxyanions , which end with the –ate ending, assume these same elements (carbon, nitrogen etc.) are cations formed by **subtracting** electrons until the inert gas core is attained and which are bonded to negatively charged oxygen anions, O2-.

**simple (ide) anions of some elements corresponding (ate) `oxyanion’**

  *charge Name core charge core formula name*

carbon C C4- carbide Ne C4+ He CO32- carbonate

nitrogen N N3- nitride Ne N5+ He NO3- nitrate

phosphorus P P3- phosphide Ar P5+ Ne PO43- phosphate

sulfur S S2- sulfide Ar S6+ Ne SO42- sulfate

chlorine Cl Cl- chloride Ar Cl7+  Ne ClO3- chlorate

**element order and charge calculation for oxyanions**

 (*POSITIVE* ELEMENT then *NEGATIVE* (O2-)

C4+ THEN 3 O2- CO32-

 +4 3\*(-2)= -6 4-6= -2

**What to do when multiple oxyanions are possible: -ate vs –ite**

 *ATE ITE*

 NO3- NO2-

 PO43- PO33-

 SO42- SO32-

 ate more eats l-ite

3) Oxyanions (continued)

special cases: names from the long history of chemistry

**1) hydrogen sequences…**

 PO4 3-  HPO4 2- H2PO4- H3PO4

**PHOSPHATE BIPHOSPHATE DIHYDROGEN PHOSPHORIC**

 **PHOSPHATE ACID**

 CO32- HCO3- H2CO3

#### CARBONATE BICARBONATE CARBONIC

 **ACID**

1. **oxyanions with more than two possibilities**

 ClO4- ClO3- Cl02- ClO- Cl-

***per***chlorate chlorate chlorite ***hypo***chlorite chloride

MnO4- MnO3- MnO2- MnO-

***per***manganatemaganate manganite  ***hypo***manganite

**3) pure memory**

 OH-

#### HYDROXIDE

 C2H3O2-

#### ACETATE

## List Of Common Oxyanions And Other Polyatomic Anions

acetate C2H3O2- (CH3COO-)

bromate BrO3-

bicarbonate HCO3‑

(hydrogen carbonate)

carbonate CO32- special cation case

ammonium NH4+

perchlorate ClO4-

chlorate ClO3-

chlorite ClO2-

hypochlorite ClO-

chromate CrO42-

chromite CrO32-

dichromate Cr2O72-

cyanide CN-

iodite IO2-

iodate IO3-

periodate IO4-

permanganate MnO4-

manganate MnO3-

manganite MnO2-

nitrite NO2-

nitrate NO3‑

hydroxide OH-

oxalate C2O42-

phosphite PO33-

phosphate PO43-

biphosphate HPO42-

(hydrogen phosphate)

dihydrogen phosphate H2PO4-

sulfite SO32-

bisulfite HSO3-

(hydrogen sulfite)

sulfate SO42-

bisulfate HSO4-

(hydrogen sulfate)