



# Chemistry

Name: \_\_\_\_\_

Section \_\_\_\_\_ BINARY COMPOUNDS Date: \_\_\_\_\_

## A. Common Binary Compounds (Type-I ionic binary)

Binary compounds usually contain two elements: a positive ion (cation) and a negative ion (anion). If the cation is polyatomic ( $\text{NH}_4^+$ , eg.), the compound is still named like a binary compound. First name the positive element (or positive polyatomic cation). The anion name must be changed slightly to obtain the binary compound name. This is done by changing the suffix of the anion to *ide*. For example,  $\text{ZnO}$  is named zinc oxide. Here are a few irregular anion names: hydrogen  $\rightarrow$  hydride, nitrogen  $\rightarrow$  nitride, oxygen  $\rightarrow$  oxide, phosphorus  $\rightarrow$  phosphide, and sulfur  $\rightarrow$  sulfide.

- |                               |       |                       |       |
|-------------------------------|-------|-----------------------|-------|
| 1. $\text{H}_2\text{S}_{(g)}$ | _____ | 6. $\text{BaO}$       | _____ |
| 2. $\text{HCl}_{(g)}$         | _____ | 7. $\text{NaF}$       | _____ |
| 3. $\text{AgCl}$              | _____ | 8. $\text{BaI}_2$     | _____ |
| 4. $\text{Na}_2\text{O}$      | _____ | 9. $\text{HBr}_{(g)}$ | _____ |
| 5. $\text{NH}_4\text{I}$      | _____ | 10. $\text{CaC}_2$    | _____ |

## B. Binary Compounds of Divalent Cations (Type-II ionic binary)

Stock System: An IUPAC acceptable method (called the Stock system) of naming binary compounds with cations that have multiple oxidation states available is to use roman numerals to differentiate the possible charges. Using iron as an example with the two common oxidation states  $\text{Fe}^{3+}$  and  $\text{Fe}^{2+}$ ;  $\text{Fe}^{3+}$  in  $\text{Fe}_2\text{O}_3$  is named iron(III) oxide [pronounced iron three oxide] and  $\text{Fe}^{2+}$  in  $\text{FeO}$  is named iron(II) oxide [pronounced iron two oxide].

- |                    |       |                    |       |
|--------------------|-------|--------------------|-------|
| 1. $\text{CuCl}$   | _____ | 5. $\text{PbI}_4$  | _____ |
| 2. $\text{CuS}$    | _____ | 6. $\text{SnO}$    | _____ |
| 3. $\text{SnCl}_2$ | _____ | 7. $\text{CoCl}_3$ | _____ |
| 4. $\text{HgCl}_2$ | _____ | 8. $\text{CoCl}_2$ | _____ |

## C. Binary Acids

Water solutions of many binary compounds containing hydrogen as the less electronegative atom will be acidic. These water solutions are named as acids. Even though they are molecular, hydrogen binary compounds are named as if they are ionic, so  $\text{HCl}_{(g)}$  is hydrogen chloride but its water solution,  $\text{HCl}_{(aq)}$ , is hydrochloric acid. Notice that the acid name is generated by using the prefix 'hydro', then the root name of the anion is used, and then the suffix 'ic' is added. Finally, the word 'acid' is added as the second part of the name.

- |                        |       |                                |       |
|------------------------|-------|--------------------------------|-------|
| 1. $\text{HI}_{(aq)}$  | _____ | 3. $\text{H}_2\text{S}_{(aq)}$ | _____ |
| 2. $\text{HCl}_{(aq)}$ | _____ | 4. $\text{HF}_{(aq)}$          | _____ |

(Go on to the next page.)

#### D. Binary Compounds that are Molecules (Type-III binary or molecular binary)

In molecular compounds, the least electronegative element can usually have multiple oxidation states. To give all the possible molecules unique names, prefixes are used to denote the number of atoms of each element to identify the compounds. If the first element has only one atom, no prefix is needed. If there is only one atom of the second element, the prefix *mono* must be used. The prefixes for one through 10 are mon(o), di, tri, tetr(a), pent(a), hex(a), hept(a), oct(a), non(a) and dec(a). As examples, SO<sub>2</sub> is sulfur dioxide and SO<sub>3</sub> is sulfur trioxide. For nitrogen compounds, many oxidation states are available to the nitrogen: NO<sub>2</sub> is nitrogen dioxide and N<sub>2</sub>O is dinitrogen monoxide, eg.

- |                      |       |                                   |       |
|----------------------|-------|-----------------------------------|-------|
| 1. PCl <sub>5</sub>  | _____ | 6. NO                             | _____ |
| 2. SiO <sub>2</sub>  | _____ | 7. NO <sub>2</sub>                | _____ |
| 3. CCl <sub>4</sub>  | _____ | 8. N <sub>2</sub> O <sub>3</sub>  | _____ |
| 4. Li <sub>2</sub> O | _____ | 9. N <sub>2</sub> O <sub>4</sub>  | _____ |
| 5. N <sub>2</sub> O  | _____ | 10. N <sub>2</sub> O <sub>5</sub> | _____ |

If you check the answer key and wonder about #4, notice that it is a Type-I ionic binary. It was added to this section to remind you that you must always check to see what type of binary you are trying to name.