Advanced CP Chemistry

Chapter 7:

Chemical Formulas & Compounds (Part 1)

**

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

Mods: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. ***What is an ion?:*** Anatom or group of atoms that have a positive or negative charge. There are two types of ions: cations and anions (see table below for differences)

|  |  |
| --- | --- |
| Cations are all METALS.Metals are to the left of the staircase.A neutral metal atom LOSES electrons.Cations are POSITIVELY charged. Cations are named the same as the atom. Ex) atom = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ion = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Anions are all NON-METALS.Non-metals are to the right of the staircase.A neutral non-metal atom GAINS electrons.Anions are NEGATIVELY charged.Anions are named by chopping the end of the atom’s name and adding “ide”.  Ex) atom = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ion = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

1. ***Octet Rule:*** All elements really want to have 8 valence electrons (like the noble gases do) so an atom will either gain, lose, or share electrons until they achieve a complete octet!

*Common Ionic Charges of the Main Group Periodic Families:*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Group #** | **1** | **2** | **13** | **14** | **15** | **16** | **17** | **18** |
| *Lewis Symbol* | Li | Be | B | C | N | O | F | Ne |
| *Gain or Lose* *-------------------**# of electrons* | ---------- | ----------- | ----------- | ----------- | ----------- | ----------- | ----------- | ---------- |
| *Ionic Charge* |  |  |  |  |  |  |  |  |

1. Fill in the table below using the relationship below.

Relationship between # of protons, # of electrons, and charge of an ion:

***# of protons – # of electrons in ion = ionic charge***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | ***Atom’s Name*** | ***Ion’s Name*** | ***Ionic Charge*** | ***# of p+ in element*** | ***# of e- in ATOM*** | ***# of e- in ION*** | ***Like which noble gas?*** |
| a. | Potassium |  |  |  |  |  |  |
| b. |  |  | –3 |  |  | 18 |  |
| c. |  |  |  | 13 |  |  |  |
| d. |  | Nitride |  |  |  |  |  |
| e. |  |  | +2 |  |  | 36 |  |
| f. | Iodine |  |  |  |  |  |  |

*Practice with Ions and Subatomic Particles*

***Directions:*** Using your knowledge of ions and the periodic table, fill in the table below.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Element** | **Ion Symbol** | **Cation (C)****or****Anion (A)** | **Name of ion** | **# of p+ in element** | **# of e- in ion** | **Like which noble gas?** |
| 1 | Lithium |  |  |  |  |  | He |
| 2 |  | Mg2+ |  |  |  |  |  |
| 3 |  |  |  | aluminum |  |  |  |
| 4 |  |  |  |  | 38 | 36 |  |
| 5 |  |  |  |  | 4 |  |  |
| 6 | Calcium |  |  |  |  |  |  |
| 7 |  | \_\_\_\_1+ |  |  |  | 54 |  |
| 8 | Phosphorus |  |  |  |  | 18 |  |
| 9 |  |  |  | sulfide |  |  |  |
| 10 |  | F1- |  |  |  |  |  |
| 11 |  |  |  | nitride |  |  |  |
| 12 |  |  |  |  | 35 |  |  |
| 13 |  | Se2- |  |  |  | 36 |  |
| 14 | Arsenic |  |  |  |  |  |  |
| 15 | Iodine |  |  |  |  |  |  |

***Directions:*** Circle the words that best complete the sentences below:

1. Cations are formed when [ *metals or nonmetals* ] [ *gain or lose* ] electrons.
2. Within a cation, there are [ *more or less* ] electrons than protons.
3. Anions are formed when [ *metals or nonmetals* ] [ *gain or lose* ] electrons.
4. Within an anion, there are [ *more or less* ] electrons than protons.

**Ionic Notes:**

1. **Ions**

Atoms are electrically neutral; however, **ions** are atoms or a group of atoms that have a **positive or negative charge**.

A \_\_\_\_\_\_\_\_\_\_\_\_ is any atom or group of atoms that have a **positive** charge.

A \_\_\_\_\_\_\_\_\_\_\_\_ is any atom or group of atoms that have a **negative** charge.

Do the metallic elements form cations or anions? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Do the non-metallic elements form cations or anions? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. **Ionic Compounds**

\*\*Ions are not electrically neutral, but ionic compounds are\*\*

An **ionic compound** is composed of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Binary** **ionic** compounds **name 🡪 formula** (criss-cross method):

|  |  |  |
| --- | --- | --- |
| a) lithium fluoride | b) barium nitride | c) magnesium oxide |

**Binary** **ionic** compounds **formula 🡪 name**:

|  |  |  |
| --- | --- | --- |
| a) NaCl | b) K2S | c) SrO |

**Ionic Notes Continued:**

Many of the transition metals have more than one common ionic charge so the **Stock system** is used. The Stock system includes a **roman numeral** after the element’s name/symbol to indicate the numerical value of charge.

**Stock system** for binary ionic compounds **name 🡪 formula** (criss-cross method):

|  |  |  |
| --- | --- | --- |
| a) Iron (II) oxide | b) Iron (III) oxide | c) Cobalt (II) nitride |

**Stock system** for binary ionic compounds **formula 🡪 name** (reverse criss-cross):

|  |  |  |
| --- | --- | --- |
| a) V2O5 | b) CuO | c) MnO2 |

**Polyatomic ions** are tightly bound groups of atoms that behave as a unit and carry a charge.

**Polyatomic ions** in an ionic compound **name 🡪 formula** (criss-cross method):

|  |  |  |
| --- | --- | --- |
| a) sodium hydroxide | b) iron (II) nitrate | c) ammonium sulfate |

**Polyatomic ions** in an ionic compound **formula 🡪 name**:

|  |  |  |
| --- | --- | --- |
| a) Ca3(PO4)2  | b) PbCO3  | c) Cr(ClO)3 |

**Polyatomic Ions List**

Knowing how to distinguish the **NAMES**, **FORMULAS**, and **CHARGES** of each polyatomic ion is crucial for writing formulas of ionic compounds correctly.

 Months of future success depend upon you understanding this concept!

|  |  |  |
| --- | --- | --- |
| **Ion Charge:** | **Ion Formula & Charge:** | **Ion Name:** |
| +1 | NH4+ | Ammonium |
|  | H3O+ | Hydronium |
| –1 | OH- | Hydroxide |
|  | CN- | Cyanide |
|  | SCN– | Thiocyanate |
|  | NO2 – | Nitrite |
|  | NO3 – | Nitrate |
|  | ClO– | Hypochlorite |
|  | ClO2 – | Chlorite |
|  | ClO3 – | Chlorate |
|  | ClO4 – | Perchlorate |
|  | BrO3 – | Bromate |
|  | IO3 – | Iodate |
|  | MnO4 – | Permanganate |
|  | HCO3 – | Bicarbonate (aka: Hydrogen Carbonate) |
|  | C2H3O2 –  or CH3COO– | Acetate |
| –2 | SO3 2– | Sulfite |
|  | SO4 2– | Sulfate |
|  | S2O3 2– | Thiosulfate |
|  | C2O4 2– | Oxalate |
|  | CO32– | Carbonate |
|  | CrO4 2– | Chromate |
|  | Cr2O7 2– | Dichromate |
| –3 | PO3 3– | Phosphite |
|  | PO4 3– | Phosphate |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | ***Name of Compound*** | ***Cation Symbol*** | ***Anion Symbol*** | ***Chemical Formula*** |
| 1 | Magnesium oxide |  |  |  |
| 2 | Francium nitride |  |  |  |
| 3 | Lithium sulfide |  |  |  |
| 4 | Strontium iodide |  |  |  |
| 5 | Aluminum bromide |  |  |  |
| 6 | Rubidium oxide |  |  |  |
| 7 | Calcium iodide |  |  |  |
| 8 | Barium chloride |  |  |  |
| 9 | Sodium bromide |  |  |  |
| 10 | Beryllium oxide |  |  |  |
| 11 | Magnesium sulfide |  |  |  |
| 12 | Aluminum nitride |  |  |  |
| 13 | Calcium chloride |  |  |  |
| 14 | Radium phosphide |  |  |  |
| 15 | Francium fluoride |  |  |  |
| 16 | Tin (II) chloride |  |  |  |
| 17 | Copper (II) iodide |  |  |  |
| 18 | Mercury (II) oxide |  |  |  |
| 19 | Vanadium (V) fluoride |  |  |  |
| 20 | Gold (III) nitride |  |  |  |
| 21 | Chromium (VI) chloride |  |  |  |
| 22 | Platinum (IV) fluoride |  |  |  |
| 23 | Chromium (III) bromide |  |  |  |
| 24 | Vanadium (IV) sulfide |  |  |  |
|  | ***Formula of Compound*** | ***Multivalent Cation? (Yes or No)*** | ***Name of Compound*** |
| 1 | NaF |  |  |
| 2 | BeI2 |  |  |
| 3 | MoS2 |  |  |
| 4 | Zn3P2 |  |  |
| 5 | CdF2 |  |  |
| 6 | PdO |  |  |
| 7 | Li2S |  |  |
| 8 | K3N |  |  |
| 9 | OsS3 |  |  |
| 10 | MgI2 |  |  |
| 11 | KI |  |  |
| 12 | NiCl3 |  |  |
| 13 | YBr3 |  |  |
| 14 | CaF2 |  |  |
| 15 | TaI5 |  |  |
| 16 | MgO |  |  |
| 17 | CuCl |  |  |
| 18 | RaS |  |  |
| 19 | AlN |  |  |
| 20 | TiBr4 |  |  |
| 21 | Fe2O3 |  |  |
| 22 | Ba3As2 |  |  |
| 23 | CrCl3 |  |  |
| 24 | CoO |  |  |
|  | ***Name of Compound*** | ***Cation Symbol*** | ***Anion Symbol*** | ***Chemical Formula*** |
| 1 | Ammonium sulfate |  |  |  |
| 2 | Sodium chlorate |  |  |  |
| 3 | Rubidium nitrate |  |  |  |
| 4 | Sodium phosphate |  |  |  |
| 5 | Aluminum acetate |  |  |  |
| 6 | Strontium sulfide |  |  |  |
| 7 | Potassium chromate |  |  |  |
| 8 | Sodium dichromate |  |  |  |
| 9 | Potassium acetate |  |  |  |
| 10 | Beryllium perchlorate |  |  |  |
| 11 | Magnesium hydroxide |  |  |  |
| 12 | Magnesium bicarbonate |  |  |  |
| 13 | Barium cyanide |  |  |  |
| 14 | Lithium carbonate |  |  |  |
| 15 | Strontium chromate |  |  |  |
| 16 | Beryllium nitrite |  |  |  |
| 17 | Ammonium nitride |  |  |  |
| 18 | Cesium carbonate |  |  |  |
| 19 | Magnesium hypochlorite |  |  |  |
| 20 | Strontium dichromate |  |  |  |
| 21 | Iron (II) cyanide |  |  |  |
| 22 | Manganese (II) phosphate |  |  |  |
| 23 | Copper (I) hydroxide |  |  |  |
| 24 | Tin (IV) permanganate |  |  |  |
|  | ***Formula of Compound*** | ***Multivalent Cation?*** ***(Yes or No)*** | ***Name of Compound*** |
| 1 | Cs3PO4 |  |  |
| 2 | Mg(NO3)2 |  |  |
| 3 | MoCrO4 |  |  |
| 4 | RaSO3 |  |  |
| 5 | Cd(ClO)2 |  |  |
| 6 | PdClO4 |  |  |
| 7 | Be(CN)2 |  |  |
| 8 | NaNO3 |  |  |
| 9 | Os(ClO2)6 |  |  |
| 10 | Al2(CO3)3 |  |  |
| 11 | BeSO4 |  |  |
| 12 | NiCl3 |  |  |
| 13 | YBr3 |  |  |
| 14 | K2Cr2O7 |  |  |
| 15 | Ta(NO2)5 |  |  |
| 16 | CsMnO4 |  |  |
| 17 | CuCl |  |  |
| 18 | Mg(C2H3O2)2 |  |  |
| 19 | (NH4)2S |  |  |
| 20 | Sn(HCO3)2 |  |  |
| 21 | Pb(ClO3)2 |  |  |
| 22 | NH4OH |  |  |
| 23 | Ca3(PO4)2 |  |  |
| 24 | CrSO4 |  |  |

**Molecular/Covalent Notes:**

1. What is a **molecular/covalent compound** composed of?
2. What is the difference between an ionic compound (ionic bonding) and a molecular compound (molecular/covalent bonding)?
3. Prefixes Used in Naming Binary Molecular Compounds

|  |  |
| --- | --- |
| **Number** | **Prefix** |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |
| 6 |  |
| 7 |  |
| 8 |  |
| 9 |  |
| 10 |  |

\*Prefixes tell how many atoms of each element are present in each molecule.

1. **Binary molecular/covalent** compounds **name 🡪 formula**:

|  |  |  |
| --- | --- | --- |
| a) carbon monoxide | b) silicon dioxide | c) diphosphorous pentoxide |

When writing a name from a formula, if there is only a single atom of the *first* element, *omit* the prefix *mono-* for that element.

1. **Binary molecular/covalent** compounds **formula 🡪 name**:

|  |  |  |
| --- | --- | --- |
| a) SCl8 | b) B3S | c) C4O5 |

*Molecular Compounds: Writing Formulas & Naming*

**Directions:** *Write the name of each of the following compounds.*

1. XeF6 1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. P3Cl9 2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. NO 3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. N2O 4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. NO2 5. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6. N2O5 6. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

7. SO2 7. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

8. CBr4 8. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

9. C2H6 9. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

10. C4H10 10. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Directions:***Write the chemical formula for each of the given names.*

11. nitrogen triiodide 11. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

12. dinitrogen tetroxide 12. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

13. sulfur trioxide 13. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

14. carbon monoxide 14. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

15. dihydrogen monoxide 15. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

16. fluorine monobromide 16. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

17. phosphorus trichloride 17. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

18. tricarbon octahydride 18. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

19. carbon tetrahydride 19. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

20. dicarbon tetrahydride 20. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Molecular Compounds: Nomenclature and Formula Writing*

**Directions:***Write the name of each of the following compounds.*

1. SiO2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. S4N2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Cl2O \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. PF3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. CCl4 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. PCl5 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. SeF6 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. As2O5 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Directions:***Write the chemical formulas for each of the given names.*

1. sulfur trioxide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. carbon tetrachloride \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. diphosphorous pentoxide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. sulfur hexafluoride \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. carbon tetrabromide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. silicon dioxide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. tetraphosphorus decoxide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. diarsenic trisulfide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Molecular Compounds: Nomenclature and Formula Writing*

**Directions:***Write the name of each of the following compounds.*

1. P4O10 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. IF7 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. CCl4 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. N2O5 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. SO3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. BF3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. SeBr6 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. CO2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Directions:***Write the chemical formulas for each of the given names.*

1. tetracarbon pentoxide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. silicon tetrabromide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. disulfur hexafluoride \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. triboron nonachloride \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. arsenic pentiodide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. chlorine heptafluoride \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. carbon monoxide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. sulfur triselenide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Mixed Review: Ionic and Molecular Compounds*

**Directions:** Below is a table filled with mixed ionic and molecular compounds. First determine if the compounds are ionic or molecular, the write the name of the compound or its chemical formula (depending which is blank).

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Name** | **Ionic (I) or Molecular (M)?** | **Formula** |
| 1 | Strontium oxalate |  |  |
| 2 |  |  | P2O4 |
| 3 |  |  | LiHCO3 |
| 4 | Aluminum cyanide |  |  |
| 5 |  |  | Sn(SO3)2 |
| 6 | Pentanitrogen heptoxide |  |  |
| 7 | Iron (III) nitrate |  |  |
| 8 |  |  | SO2 |
| 9 |  |  | Cs3PO4 |
| 10 | Manganese (III) acetate |  |  |
| 11 | Calcium chlorate |  |  |
| 12 |  |  | NBr3 |
| 13 | Tetraoxygen hexafluoride |  |  |
| 14 |  |  | CoCO3 |
| 15 | Copper (II) nitrite |  |  |
| 16 |  |  | Mo(C2O4)2 |
| 17 | Silicon dioxide |  |  |
| 18 | Rhenium (VI) dichromate |  |  |

*Mixed Review Continued: Ionic and Molecular Compounds*

**Directions:** Below is a table filled with mixed ionic and molecular compounds. First determine if the compounds are ionic or molecular, the write the name of the compound or its chemical formula (depending which is blank).

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Name** | **Ionic (I) or Molecular (M)?** | **Formula** |
| 19 |  |  | Pb(SCN)2 |
| 20 | Arsenic disulfide |  |  |
| 21 | Yttrium (III) phosphite |  |  |
| 22 |  |  | B2S3 |
| 23 |  |  | Zn(ClO)2 |
| 24 | Silver sulfate |  |  |
| 25 |  |  | Si2O |
| 26 | Tantalum (V) perchlorate |  |  |
| 27 |  |  | K2CrO4 |
| 28 |  |  | Mg3P2 |
| 29 | Tricarbon octahydride |  |  |
| 30 | Beryllium hydroxide |  |  |
| 31 |  |  | Cd(MnO4)2 |
| 32 | Ammonium selenide |  |  |
| 33 |  |  | As3O5 |
| 34 |  |  | Os(S2O3)3 |
| 35 | Silver chlorite |  |  |
| 36 | Heptaphosphorus nonoxide |  |  |

*Acid Nomenclature & Formulas:*

1. **Acid Basics:**
* All acids have a **common cation of H+** so every acid formula will begin with “H”
* Each acid also contains an **anion** (could be monatomic *or* polyatomic)
* Just like any other compound, acids are electrically neutral
	+ Thus, # of H+ ions is determined by the charge of the anion

 Examples: **H2SO4** has 2 H+ ions to balance the 2- charge of SO42–

1. **Rules for Naming Acids that Contain Monatomic Anions:**
* Since all these acids have the same cation, H+, we don't need to name the cation.
* The acid name comes from the root name of the anion.
* The prefix hydro- and the suffix -ic are then added to the root name of the anion.

Examples: **HCl,** which contains the anion chloride, is called hydrochloric acid.

 **HF**, which contains the anion fluorine, is called hydrofluoric acid.

1. **Rules for Naming Oxyacids (anion contains the element oxygen):**
* Since all these acids have the same cation, H+, we don't need to name the cation.
* The acid name comes from the root name of the oxyanion.
* Suffixes are used based on the ending of the original name of the oxyanion:
	+ If the name of the polyatomic anion ended with -ate, in the acid change it to -ic
	+ If the name of the polyatomic anion ended with -ite, in the acid change it to -ous

 Examples: **HNO3**, which contains the polyatomic ion nitrate, is called nitric acid.

 **HNO2**, which contains the polyatomic ion nitrite, is called nitrous acid.

 **HClO4**, which contains the polyatomic ion perchlorate, is called perchloric acid.

**ate/ic 🡪 higher # oxygens**

**ite/ous 🡪 lower # oxygens**

*Naming Acids Notes*

Acids are compounds that can donate the hydrogen ion, H+. When the formula for an acid is written the symbol for hydrogen generally appears at the beginning of the formula. For example, the formula for hydrochloric acid is written as *HCl* and the formula for phosphoric acid is H3PO4. Notice that both formulas begin with hydrogen (H). In both cases the caid is made up of one or more hydrogen ions and a negative ion, known as the **anion**.

The name for an acid is based on the name of the anion. If the anion ends with the letters –ide, the acid is named one way while acids containing anions that end with –ate use a different rule. Remember that monatomic anions (such as Br- and S2-) typically end with –ide. The rules for naming acids are summarized below.

*Rules for Naming Acids:*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Anion called:  **(root) -ide** |  | Anion called:  **(root) -ite** |  | Anion called :  **(root) --ate** |
| *Example:* *chlor****ide****, Cl-* |  | *Example:**chlor****ite****, ClO2-* |  | *Example:* *chlor****ate****, ClO3-* |
| Acid called: **hydro (root) -ic acid** |  | Acid called: **(root) -ous acid** |  | Acid called: **(root) -ic acid** |
| *Example:****hydro****chlor****ic******acid****, HCl* |  | *Example:**chlor****ous******acid****, HClO2* |  | *Example:**chlor****ic******acid****, HClO3* |
| *ide 🡪 hydro\_\_\_\_ic* |  | *ite 🡪 ous* |  | *ate 🡪 ic* |

Examples:

#1) Write the chemical formula for sulfurous acid: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* This acid contains the hydrogen ion and the sulfite anion (this is known due to the acid name ending in –ous)
* Create a neutral compound from these ions

#2) Name the acid H2CO3: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* This acid contains the hydrogen ion and the carbonate anion (to determine this, remove all the hydrogen ions to see what anion is left over as the root of the acid)
* Pay close attention to the ending of the anion

*Acid Names & Formulas Practice WS*

**Directions:** Fill in the following table with the missing information:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Formula** | **Cation** | **Formula for Anion** | **Name of Anion** | **Name of Acid** |
| 1 | HCl | H+ | Cl- | chloride |  |
| 2 | HNO3 | H+ |  | nitrate |  |
| 3 |  | H+ | F- |  | hydrofluoric acid |
| 4 | H2SO4 | H+ | SO42- |  |  |
| 5 | H2SO3 | H+ |  | sulfite |  |
| 6 |  | H+ | ClO3- |  | chloric acid |
| 7 |  | H+ |  | phosphate |  |
| 8 | H2C2O4 | H+ |  | oxalate |  |
| 9 |  | H+ |  |  | hydrocyanic acid |
| 10 |  | H+ |  |  | acetic acid |
| 11 |  | H+ | I- |  |  |
| 12 |  | H+ |  | sulfide |  |
| 13 | HClO | H+ |  |  |  |
| 14 |  | H+ | AsO43- | arsenate |  |
| 15 |  | H+ |  |  | nitrous acid |

*Acids: Nomenclature and Formula Writing*

**Directions:***Write the name of each of the following acids.*

1. HClO2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. HClO3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. H2SO4 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. HBr \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. HNO3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. HNO2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. H2S \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Directions:***Write the chemical formulas for each of the acids given below.*

1. sulfurous acid \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. hydrobromic acid \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. hydrocyanic acid \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. phosphoric acid \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. thiosulfuric acid \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. acetic acid \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. carbonic acid \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Acids: Nomenclature and Formula Writing… continued*

**Directions:***Write the name of each of the following acids.*

1. HClO \_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. HMnO4 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. H3N \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. H3PO4 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. H2CrO4 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. HI \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. HIO3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Directions:***Write the chemical formulas for each of the acids given below.*

1. perchloric acid \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. dichromic acid \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. oxalic acid \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. hydrofluoric acid \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. bromic acid \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. thiocyanic acid \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. hydrophosphoric acid \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Mixed Nomenclature Practice:*

*Ionic Compounds, Molecular Compounds, and Acids*

**Directions:**

*Fill in the table by identifying the following as ionic, covalent, or an acid and the name the compounds*

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Formula** | **Ionic (I)** **Molecular (M)****Acid (A)** | **Name** |
| 1. | BaSO3 |  |  |
| 2. | (NH4)ClO2 |  |  |
| 3. | PBr |  |  |
| 4. | HClO |  |  |
| 5. | MgSO4 |  |  |
| 6. | CCl4 |  |  |
| 7. | CrCO3 |  |  |
| 8. | Na2Cr2O7 |  |  |
| 9. | H3PO4 |  |  |
| 10. | S2P5 |  |  |
| 11. | Cu3PO3 |  |  |
| 12. | HI |  |  |
| 13. | AgNO2 |  |  |
| 14. | CH4 |  |  |
| 15. | Fe(C2H3O2)2 |  |  |
| 16. | N2O |  |  |
| 17. | SnO2 |  |  |

*Mixed Formula Practice Continued:*

*Ionic Compounds, Molecular Compounds, and Acids*

**Directions:** *Fill in the table by identifying the following as ionic, covalent, or an acid and writing*

 *the formula for the compounds*

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Name** | **Ionic (I)** **Molecular (M)****Acid (A)** | **Formula** |
| 1. | nitric acid |  |  |
| 2. | lithium oxalate |  |  |
| 3. | chromium (II) phosphide |  |  |
| 4. | magnesium nitride |  |  |
| 5. | Dinitrogen trifluoride |  |  |
| 6. | titanium (IV) oxide |  |  |
| 7. | hydrocyanic acid |  |  |
| 8. | aluminum bicarbonate |  |  |
| 9. | zinc iodate |  |  |
| 10. | pentaphorphorous monoxide |  |  |
| 11. | sodium chromate |  |  |
| 12. | Potassium permanganate |  |  |
| 13. | sulfur hexabromide |  |  |
| 14. | lead (II) thiosulfate |  |  |
| 15. | perchloric acid |  |  |
| 16. | ammonium hydroxide |  |  |
| 17. | silver sulfate |  |  |

*Chapter Seven (Part 1) Review Worksheets*

1. Use your periodic table to fill in the missing information in the chart below.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Name of Ion | Charge of Ion | Atomic Mass | Atomic Number | # of protons | # of neutrons | # of electrons |
|  | 2+ | 184 | 74 |  |  |  |
|  | 1- |  | 35 |  | 45 |  |
|  |  | 197 |  |  | 118 | 78 |
| Rubidium | 1+ | 85 |  |  |  |  |
|  | 3- |  | 7 |  | 7 |  |

1. Fill in the charts below with the names and formulas for **ionic** compounds.

|  |  |
| --- | --- |
| Formula | Name |
| Ca(OH)2 |  |
| Cs2O |  |
| Fe2S3 |  |
| Cu2SO4  |  |
| KMnO4 |  |

|  |  |
| --- | --- |
| Formula | Name |
|  | Strontium nitride |
|  | Tin (IV) oxide |
|  | Cobalt (III) carbonate |
|  | Aluminum perchlorate |
|  | Magnesium nitrite |

1. Fill in the names of the following **molecular/covalent** compounds.

|  |  |
| --- | --- |
| Formula | Name |
| N2Br3 |  |
| N2O4 |  |
| CCl4 |  |
| P2O5 |  |
| SF6 |  |

|  |  |
| --- | --- |
| Formula | Name |
|  | Diphosphorous decachloride |
|  | Dihydrogen monoxide |
|  | Xenon hexaflouride |
|  | Dinitrogen monoxide |
|  | Carbon triiodide |

1. Decide if each of the following is ionic or molecular/covalent and fill in the name.

|  |  |  |
| --- | --- | --- |
| Formula | Ionic (I) /Molecular (M)? | Name |
| Ba(IO3)2 |  |  |
| BF3 |  |  |
| VN |  |  |
| SO2 |  |  |
| PCl5 |  |  |

1. Fill in the following table: mixed review!

|  |  |
| --- | --- |
| Formula | Name |
| HF  |  |
|  | Nitrogen disulfide |
|  | Hypochlorous acid |
| PbO2 |  |
| C2I6 |  |
|  | Ammonium phosphite |
| H2Cr2O7 |  |

1. Identify the **error(s)** in the following names and provide the appropriate name for the formula provided.

|  |  |  |
| --- | --- | --- |
| Formula  | Name | Correct Name |
| Cu(NO2)2 | Copper nitrate |  |
| HClO3 | Perchloric acid |  |
| Na2CO3 | Sodium carbon trioxide |  |
| KBr | Potassium monobromide |  |
| FeO | Lead (II) oxide |  |
| PCl3 | Monophosphide tetrachloride |  |