Honors Chemistry Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Enloe High School

Unit 4 Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Period:\_\_\_\_\_\_\_\_\_

**The Language of Chemistry**

**Essential Standards**

**Chm.1.2 Understand the bonding that occurs in simple compounds in terms of bond type, strength, and properties.**

Chm.1.2.4 Interpret the name and formula of compounds using IUPAC convention.

**Chm.1.3 Understand the physical and chemical properties of atoms based on their position on the Periodic Table.**

Chm.1.3.1 Classify the components of a periodic table (period, group, metal, metalloid, nonmetal, transition)

**Students should be able to:**

1. Categorize elements based on their geographic location on the periodic table.
2. Identify substances as either a element or a compound given the name or chemical formula
3. Use the term cation as a positively charged ion and anion as a negatively charged ion
4. Predict ionic charges for main group elements base on valence electrons
5. Write polyatomic ions with a charge
6. Write name and formula for ionic compounds using the Stock System for naming
7. Write name and formula for binary covalent compounds
8. Write the name and formula for acids
9. Write the name and formula for bases
10. Write the name and formula for hydrates

**Assignment 1: Elements v. Compounds**

An element is substance for which there is only one type of atom. A compound is substance for which there are two or more different types of atoms chemically bonded in definite proportions.

**Practice**

Classify the following as to whether it is an element or a compound by writing E or C in the space provided.

|  |  |  |  |
| --- | --- | --- | --- |
| 1. Sodium | \_\_\_\_\_\_\_\_\_\_ | 11. Mercury | \_\_\_\_\_\_\_\_\_\_ |
| 2. Pure water | \_\_\_\_\_\_\_\_\_\_ | 12. O3 | \_\_\_\_\_\_\_\_\_\_ |
| 3. Sugar | \_\_\_\_\_\_\_\_\_\_ | 13. (NH3)2SO4 | \_\_\_\_\_\_\_\_\_\_ |
| 4. Al | \_\_\_\_\_\_\_\_\_\_ | 14. Nitrogen | \_\_\_\_\_\_\_\_\_\_ |
| 5. Carbon | \_\_\_\_\_\_\_\_\_\_ | 15. Methane | \_\_\_\_\_\_\_\_\_\_ |
| 6. Isopropyl alcohol | \_\_\_\_\_\_\_\_\_\_ | 16. S8 | \_\_\_\_\_\_\_\_\_\_ |
| 7. Carbon dioxide | \_\_\_\_\_\_\_\_\_\_ | 17. C3H8 | \_\_\_\_\_\_\_\_\_\_ |
| 8. Lead | \_\_\_\_\_\_\_\_\_\_ | 18. NaHCO3 | \_\_\_\_\_\_\_\_\_\_ |
| 9. NaCl | \_\_\_\_\_\_\_\_\_\_ | 19. Cu | \_\_\_\_\_\_\_\_\_\_ |
| 10. HC2H3O2 | \_\_\_\_\_\_\_\_\_\_ | 20. CoO | \_\_\_\_\_\_\_\_\_\_ |

III. True or False

|  |  |
| --- | --- |
| \_\_\_\_\_ | 1. Compounds have a variable composition.
 |
| \_\_\_\_\_ | 1. Elements have a variable composition.
 |
| \_\_\_\_\_ | 1. Compounds can be separated by physical means.
 |
| \_\_\_\_\_ | 1. Elements consist of only one type of atom.
 |
| \_\_\_\_\_ | 1. A material with a constant composition that cannot be separated by ordinary chemical means is a compound.
 |

**Assignment 4: Ions (The Stock System)**

1. Cations formed from metal atoms have the same name as the metal.

Na+  Sodium ion Zn2+ Zinc ion Al3+ Aluminum ion

Common cations and their charges

Group 1A +1

Group 2A +2

Silver +1

Zinc +2

Aluminum +3

1. If a metal can form cations of differing charges, the positive charge is given by a Roman number in parantheses following the name of the metal.

Fe2+ Iron (II) ion Cu+ Copper (I) ion

Fe3+ Iron (III) ion Cu2+ Copper (II) ion

Most of the Transition metals and metals under the staircase form multiple ions. A list of common ions that may be useful can be found on pages 55 and 124 of your book (Chang Chemistry)

1. Monatomic anions have names formed by replacing the ending of the name of the element with -**ide**.

Common anions and their charges

Group 7A -1

Group 6A nonmetals -2

Group 5A nonmetals -3

1. Oxyanions (polyatomic ions that contain oxygen)
	1. The most common oxyanion is given the ending **–ate**.
	2. The ion with 1 less oxygen that –ate is given the ending **–ite**
	3. The ion with 1 less oxygen than –ite is given the prefix **hypo-**.
	4. The ion with 1 more oxygen than the –ate anion is given the prefix **–per**.

Example: ClO- Hypochlorite ClO3- Chlorate

ClO2- Chlorite ClO4- Perchlorate

1. Polyatomic ions, or many atom ions. You must memorize the chemical formula and name for the polyatomic ions listed in the reference table plus the others put on the board.

**Assignment 5: Ionic Compound Nomenclature**

**Writing Formulas for Ionic Compounds**

Rules

1. The formulas of ionic compounds are always the same as their empirical formulas because ionic compounds do not exist as discrete molecules.
2. The formula of an ionic compound must be electrically neutral

Step by Step

1. Write the chemical formula for the cation.
2. Write the chemical formula for the anion.
3. Find the least common multiple between the two charges on the cation and anion.
4. The subscript for each ion will be the factor needed to reach the least common multiple.
5. Use parentheses with a subscript on the outside only for polyatomic ions.
6. Reduce subscripts to the smallest ratio.

**Naming Ionic Compounds**

Step by Step

1. Divide the formula into the positive half and the negative half (cation and anion).
2. Write the name for the positive ion.
3. Write the name for the negative ion.
4. Use the charge for the negative ion to determine the oxidation state for the positive ion when a roman numeral is needed.
5. If the positive ion is monatomic and NOT in column IA or IIA and is NOT silver, zinc, or aluminum, you must use a roman numeral to name it. ( Stock System )
6. Write the name of the cation and then the name of the anion.

**Assignment 6: Writing Formulas for Ionic Compounds**

Write the correct formula for each of the following ionic compounds.

1. barium chloride 2. calcium oxide

3. magnesium sulfate 4. silver bromide

5. zinc carbonate 6. ammonium nitrate

7. aluminum sulfide 8. copper (II) hydroxide

9. lead (II) phosphate 10. iron (III) sulfate

11. chromium (III) fluoride 12. nickel (II) carbonate

13. potassium bicarbonate 14. calcium chromate

15. mercury (II) iodide 16. sodium bicarbonate

17. lead (II) chromate 18. copper (I) chloride

19. mercury (II) nitrate 20. iron (III) oxide

21. aluminum hydroxide 22. copper (I) oxide

23. ammonium sulfide 24. lead (II) acetate

25. iron (III) bromide 26. magnesium bicarbonate

27. silver sulfide 28. potassium sulfite

29. chromium (III) sulfate 30. sodium phosphate

31. ammonium sulfate 32. barium phosphate

33. nickel (IV) oxide 34. zinc phosphate

35. calcium hypochlorite 36. lithium chlorate

37. sodium perchlorate 38. sodium sulfite

39. potassium sulfide 40. mercury (II) oxide

**Assignment 7: Naming Ionic Compounds**

Naming compounds from their formulas is another important skill for you to master. To do this, you divide the formula into the positive half and the negative half (cation and anion). Write the name for the positive ion. Then write the name for the negative ion. If the positive ion is monatomic and NOT in column IA or IIA and is NOT silver, zinc, or aluminum, you must use a roman numeral to name it. Use the charge for the negative ion to determine the oxidation state for the positive ion when a roman numeral is needed.

Write the correct name for each of the following ionic compounds

1. CuCl2 2. CaS

3. KHSO4 4. NaHCO3

5. KOH 6. HgCl2

7. Fe (OH)3 8. Ni (C2H3O2)2

9. NaNO3  10. NaNO2

11. Ni3 (PO4)2 12. NaOH

13. NH4NO3 14. Mg3 (PO4)2

15. FeSO4 16. Ag2CO3

17. Hg2Cl2 18. K2SO4

19. BaCrO4 20. Cr (OH)3

21. PbBr2  22. HgI2

23. Ca (NO3)2 24. Pb (NO3)2

25. CsF 26. BaCl2

27. AlPO4 28. AlN

29. KCl 30. KClO3

31. Ba (HCO3)2 32. TiBr3

33. K3PO4 34. NaClO3

35. CuCO3  36. CuSO4

37. FeCl3 38. Zn (CN)2

39. H2O2 40. AgNO3

**Assignment 8: Naming and Writing Formulas for Covalent Compounds**

1. Binary Molecules are molecules composed of only two elements. If the elements are both nonmetals, then a prefix system is sometimes used to name and write formulas.
2. Greek prefixes are used to indicate the number of atoms of each element. You must memorize the following prefixes:

mono 1 di 2

tri 3 tetra 4

penta 5 hexa 6

hepta 7 octa 8

nona 9 deca 10

1. When the prefix ends in *a* or *o* and the name of the second elements begins with a vowel (such as oxide), the *a* or *o* is often dropped.
2. The first word of the name is made up of (a) a prefix indicating the number of atoms of the first element appearing in the formula, if more than one(The prefix mono- is never used with the first element); and (b) the name of the first element in the compound.

1. The second word of the name is made up of (a) a prefix indicating the number of atoms of the second element appearing in the formula; and (b) the root of the name of the second element with the ending **–ide.**

**Practice**

Give the name or formula for the following compounds using the prefix system.

1. Carbon monoxide 11. CO2

1. Sulfur trioxide 12. SO2
2. Phosphorus trichloride 13. P4O10
3. Carbon tetrabromide 14. N2O3
4. Dinitrogen pentoxide 15. SiCl4
5. Phosphorus tribromide 16. As2O5
6. Carbon tetrachloride 17. N2O
7. Sulfur hexafluoride 18. SF6
8. Dinitrogen tetroxide 19. IF5
9. Tetraphosphorus hexasulfide 20. XeO3

# **Assignment 9: Naming Acids**

1. An acid can be described as a substance that yields hydrogen ions when dissolved in water.
2. Most of the time acids will be written as H as the first element.
3. The name for an acid is derived from the name of the anion.

Anion Acid

\_\_\_\_\_\_\_\_\_ate \_\_\_\_\_\_\_\_\_ic acid

\_\_\_\_\_\_\_\_\_ite \_\_\_\_\_\_\_\_\_ous acid

\_\_\_\_\_\_\_\_\_ide hydro\_\_\_\_\_\_\_\_\_ic acid

**Problems**

1. Name the following acids

a. HC2H3O2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ b. H2CO3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

c. HCl \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ d. HNO2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

e. HClO2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ f. H3PO4 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

g. H2SO4 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ h. HCN \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

i. HF \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ j. HNO3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

k. H2SO3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ l. HC2H3 O2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

m. HBr \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ n. H2 S\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

o. HClO4 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ p. H3AsO4 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

q. HBrO2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ r. HI \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

s. HClO \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ t. H3PO3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. Write the formulas for the following acids.

1. oxalic acid (C2O4-2 is oxalate ion) b. phosphorous acid

c. periodic acid d. sulfuric acid

e. hydrobromic acid f. permanganic acid

g. nitric acid h. arsenic acid (AsO43- is arsenate)

i. chloric acid j. hypochlorous acid

k hydrosulfuric acid l. phosphoric acid

m bromous acid n. sulfurous acid

o. hydrochloric acid p. acetic acid

q. iodous acid r. arsenous acid (AsO43- is arsenate)

s. perchloric acid t. carbonic acid

u. iodic acid

**Assignment 10: Bases**

1. A base can be described as a substance that yields OH- ions when dissolved in water.

1. Name the following bases:
2. NaOH b. KOH c. Mg (OH)2

1. Ba (OH)2  e. NH3 f. CaO

**Assignment 11: Hydrates**

1. Hydrates are compounds that have a specific number of water molecules attached to them

1. Write the formulas for the following hydrates:
2. barium chloride dihydrate

1. magnesium sulfate heptahydrate
2. strontium nitrate tetrahydrate
3. copper (II) sulfate pentahydrate
4. sodium carbonate decahydrate

**Assignment 12: Cumulative Practice**

Directions: Give the name or formula for each of the following.

 1. carbon dioxide 26. NO2

1.

 2. acetic acid 27. CO

1. bromide ion 28. N2O5
2. calcium chloride 29. Cr+2
3. tetraphosphorus decasulfide 30. Ti+3
4. sodium bicarbonate 31. NaClO3
5. ammonium sulfate 32. K3PO4
6. nickel (IV) oxide 33. TiBr3
7. zinc phosphate 34. Ba (HSO3)2
8. cupric carbonate 35. Zn (CN)2
9. silicon dioxide 36. Sr (NO3)2
10. nitrous acid 37. H2SO3
11. chromate ion 38. SnBr4
12. periodic acid 39. AgNO3
13. hydrogen phosphide 40. KCN
14. hydrofluoric acid 41. HCl
15. hydrogen sulfide 42. Ba (OH)2
16. chloric acid 43. K2S
17. lithium chlorate 44. SO3
18. scandium (III) carbonate 45. Hg2Cl2
19. sodium hypochlorite 46. (NH4)2SO4
20. lead (II) hydroxide 47. H3PO4
21. nitride 48. N2O
22. chromate 49. HI
23. sodium peroxide 50. Pb(C2O4)2

**Assignment 13: Cumulative Practice**

Directions: Give the name or formula for each of the following.

1. copper (I) ion 26. SO4-2

1. chloride ion 27. HSO4-1
2. ammonium 28. OH-
3. bisulfate 29. CO2
4. carbonic acid 30. NH3
5. barium chloride 31. HClO4
6. magnesium sulfate 32. HNO3
7. silver bromide 33. CaO
8. zinc carbonate 34. HgCl2
9. ammonium nitrite 35. K2O2
10. aluminum sulfide 36. Fe (OH)3
11. copper (II) hydroxide 37. Ni (C2H3O2)2
12. lead (II) phosphate 38. KHSO4
13. iron (III) sulfate 39. CaS
14. chromium (III) fluoride 40. Ni3 (PO4)2
15. nickel (II) chlorate 41. Mg3 (PO4)2
16. oxalic acid 42. N2O5
17. sulfur trioxide 43. Ag2CO3
18. dinitrogen pentoxide 44. BaCr2O7
19. perchlorate 45. Cr (OH)3
20. hydrochloric acid 46. PbBr2
21. copper (I) chloride 47. HgO
22. lead (II) acetate 48. KMnO4
23. cuprous oxide 49. Al2S3
24. chromium (III) sulfate 50. HI