**Salt Lake Community College, Chemistry Department**

**Chem 1110 Workshop 7- part II**

**Topic: Chemical Equations**

***Objective:***

* To be able to determine oxidation numbers of atoms and determine which substances are being reduced and which oxidized in a reaction
* To be able to recognize spectator ions and write net ionic equations

**Solubility Rules:**

* **Rule 1:** ionic compounds with Group I cations (Na+, K+, Li+) and ammonium ion (NH4+) are always soluble. Regardless of anion, if an ionic compound has one of these cations, it will \*always\* be soluble.
* **Rule 2:** ionic compounds with acetate ion (C2H3O2-), nitrate ion (NO3-), and perchlorate (ClO4- ) as anions are always soluble.
* **Rule 3:** ionic compounds with halogens (group 7A) as anions are always soluble unless the cation is Ag+, Hg2+, or Pb2+ \*\*\*\*Note: Don’t forget these exceptions!
* **Rule 4:** ionic compounds with sulfate (SO42- ) as an anion are always soluble unless the cation is Ag+, Hg2+, Pb2+, Ca2+, Sr2+, or Ba2+.
* **Rule 5:** ionic compounds with carbonate (CO32-), phosphate (PO43-), sulfide (S2-), and hydroxide (OH-)as anions are always insoluble unless the cation is a Group 1 cation or ammonium ion or unless the compound is a strong base.

**Molecular, Ionic and net ionic equations:**

1. Chemical equations are a shorthand way of describing a chemical reaction
2. There are different types of chemical equations
3. Molecular equations - all reactants and products are written as complete molecules even though they may exist as ions in solution
4. Complete ionic equations - strong electrolytes are written as ions if they are in aqueous solution
5. Net ionic equations - spectator ions are canceled and the actual reaction that takes place is left

**Practice Problems:**

1. Which of the following is **not** soluble in water?

1. potassium sulfide
2. iron(II) bromide
3. **iron(III) hydroxide**
4. iron(III) nitrate
5. ammonium sulfate

2. Complete and balance the following reactions.

Ca(NO3)2 (aq) + Na3PO4 (aq) **→**

**Molecular Equations:** 3 Ca(NO3)2 (aq) + 2 Na3PO4 (aq) **→** Ca3(PO4)2 (s) + 6 NaNO3 (aq)

**Ionic Equation:** 3Ca2+ (aq) + 6NO3- (aq) + 6Na+ (aq) + 2PO43- (aq) 🡪 Ca3(PO4)2 (s) + 6Na+ (aq) + 6NO3- (aq)

**Net Ionic Equation:** 3Ca2+ (aq) + 2PO43- (aq) 🡪 Ca3(PO4)2 (s)

3. Write and balance the following acid-base neutralization reaction:

1. H3PO4 (aq) + Mg(OH)2 (aq) 🡪

**Molecular equation:** 2H3PO4 (aq) + 3Mg(OH)2 (aq) 🡪 Mg3(PO4)2 (s) + 6H2O(l)

**Ionic Equation:** 2H3PO4 (aq) + 3Mg2+ (aq) + 6OH- (aq) 🡪 Mg3(PO4)2 (s) + 6H2O(l)

**Net Ionic Equation:** 2H3PO4 (aq) + 3Mg2+ (aq) + 6OH- (aq) 🡪 Mg3(PO4)2 (s) + 6H2O(l)

1. Complete and balance each of these reactions? If no reaction occurs write “no reaction.”
2. Zn(NO3)2 (aq) + (NH4)2S (aq) 🡪 **ZnS (s) + 2NH4NO3 (aq)**
3. Na2CO3(aq) + 2AgNO3 (aq)🡪 **2NaNO3 (aq) + Ag2CO3 (s)**
4. Ca(OH)2 (aq) + 2HCl (aq) 🡪 **2H2O (l) + 2CaCl2**
5. C5H12 +8O2 (aq) 🡪 **5CO2 + 6H2O**

5. The oxidation number of iron in the compound FeBr3 is

1. -2.
2. -1.
3. +1.
4. +2.
5. **+3.**

6. The oxidation number of sulfur in calcium sulfate, CaSO4, is

1. **+6.**
2. +4.
3. +2.
4. 0.
5. -2.