Chemical Reactions #1

Writing Chemical Reactions

- In order to be able to write a chemical reaction, you MUST know how to write formulas from names!
- If you still cannot do this…you are going to have MAJOR trouble

Steps for Balancing Chemical Equations

- Write the _____ equation for the reaction
- Count the number of atoms of each element of the _____
- Count the number of atoms of each element of the _____
- Add / Change the _____ to make the numbers of each element equal
- YOU CAN NEVER CHANGE A SUBSCRIPT!
- Write the coefficients in the _____ possible ratio
- Check your work

Example

- Write and balance the reaction between sodium hydroxide and calcium bromide to give calcium hydroxide and sodium bromide

Small Intro to Redox (MUCH more on this later!)

- A reaction in which electrons are transferred from one atom to another is called an _____ **reaction**.

Determining Oxidation Numbers

1. The oxidation number for any uncombined elements or diatomic molecule is _____
2. The oxidation number for a monatomic ion is its _____
3. The oxidation number of Hydrogen is usually _____ . The exception is in a _____ where the oxidation number will be -1
4. The oxidation number of oxygen is usually _____ EXCEPT in _____ . Then it is -1

Determining Oxidation Numbers

5. In binary compounds (nonmetal + nonmetal) the more electronegative element gets a negative oxidation number.
   - This usually means the positive one is first and the negative one is second
6. The sum of the oxidation numbers for all atoms in a neutral compound is _____
7. The sum of the oxidation numbers in a polyatomic ion is equal to the _____ of the polyatomic ion

Equations

- _____ **equations** – show the complete chemical formulas. Does not indicate ionic character

- _____ **equation** – shows all ions. Actually how the particles exist in the solution

Steps for Writing Ionic Equations

1. Write the balanced molecular equation (balanced chemical equation)
2. Break every thing down into its ions **EXCEPT** the _____ , _____, _____ , or _____ (complete ionic equation)
3. Cross out everything that is the same on both sides (_____ ions)
4. Write what is left (net ionic equation)

Rules

- When writing ionic equations, you must keep together the solid, gas, water, or weak electrolyte
- **Spectator ions** – ions that appear on both sides of the equation. They have very little to do with the chemical reaction

A few more things that you must know…

- When writing ionic reactions…you must be able to identify the solid, gas or weak electrolyte
- In order to know what is solid…you MUST memorize the solubility rules
- You must also be able to identify strong electrolytes…
- They are all strong acids & bases
  - Strong acids…HCl, HBr, HI, $HClO_3$, $HClO_4$, HNO_3, HIO_4, H_2SO_4
  - Strong bases…all group 1A & 2A hydroxides

Solubility Rules

SOLUBILITY RULES

Always soluble:

alkali metal ions (Li^+, Na^+, K^+, Rb^+, Cs^+), NH_4^+, NO_3^-, ClO_3^-, ClO_4^-, $C_2H_3O_2^-$

Generally soluble: (mnemonics)

Cl^-, Br^-, I^-	Soluble except Ag^+, Pb^{2+}, Hg_2^{2+} (AP/H)
F^-	Soluble except Ca^{2+}, Sr^{2+}, Ba^{2+}, Pb^{2+}, Mg^{2+} (CBS-PM)
SO_4^{2-}	Soluble except Ca^{2+}, Sr^{2+}, Ba^{2+}, Pb^{2+} (CBS/PBS)

Generally insoluble:

O^{2-}, OH^-	Insoluble except and alkali metals, and NH_4^+ Ca^{2+}, Sr^{2+}, Ba^{2+} (CBS) somewhat soluble
CO_3^{2-}, PO_4^{3-}, S^{2-}, SO_3^{2-}, $C_2O_4^{2-}$, CrO_4^{2-}	Insoluble except alkali metals and NH_4^+

Classification of Reactions

- There are 5 major classifications of reactions:
  - _____(Combination)
  - _____
  - _____
  - _____
  - _____(Metathesis)

Synthesis # 1

1. Metal oxide + nonmetal oxide → salt (Not Redox)

Synthesis # 1 Example

- Sulfur dioxide gas is passed over solid calcium oxide

Synthesis # 2

2. Metal oxide + water → base (Not Redox)
- Solid sodium oxide is added to water

Synthesis #3

3. Non metal oxide + water → acid
- Sulfur dioxide gas is placed in water

Synthesis # 4

4. Metal + nonmetal → salt (Redox…NO IONS)
- A salt is just an ionic compound (a positive charge & a negative charge)
- Magnesium metal is combusted in nitrogen gas

Decomposition

Synthesis		Decomposition
	Redox	
Metal + Nonmetal → salt		Salt → Metal + Nonmetal
	Non Redox	
Metal oxide + H_2O → base		base → Metal oxide + H_2O
Nonmetal oxide + H_2O → acid		acid →Nonmetal oxide + H_2O
Metal oxide + Nonmetal oxide → salt		salt → Metal oxide + Nonmetal oxide

More Decomposition

- Metal chlorates → metal chloride + O_2
- $(NH_4)_2CO_3 \rightarrow 2NH_3 + H_2O + CO_2$
- $2H_2O_2 \rightarrow 2H_2O + O_2$
- If you get any of these products…they decompose…
  - $NH_4OH \rightarrow NH_3 + H_2O$
  - $H_2CO_3 \rightarrow CO_2 + H_2O$
  - $H_2SO_3 \rightarrow SO_2 + H_2O$
  - $HNO_2 \rightarrow NO + NO_2 + H_2O$