

### Balancing Chemical Equations Notes

Chemical Change is represented by chemical equations

Symbols and terms used in chemical equations:

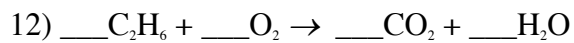
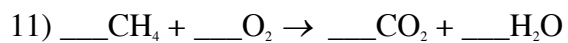
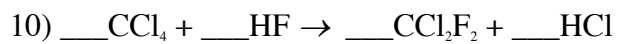
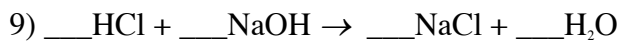
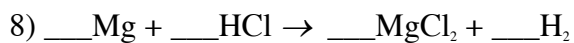
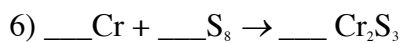
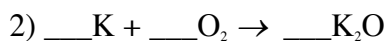
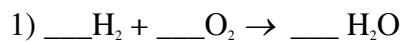
Yields	Reactants	Product
Solid	liquid	gas
Aqueous	gas released	precipitate
Exothermic	Endothermic	

### Counting Atoms

NaCl	Na _____
	Cl _____
MgCl <sub>2</sub>	Mg _____
	Cl _____
Mg(NO <sub>3</sub> ) <sub>2</sub>	Mg _____
	N _____
	O _____
2NH <sub>4</sub> NO <sub>3</sub>	H _____
	N _____
	O _____

**Conservation of Atoms**

Balance the following equations. No fractions!



**Writing Chemical Equations**

Sometimes we must create the equation that describes our reaction.

How do you know what state of matter something is in?

Gases

Liquids

Aqueous

Solids

Solid sulfur plus oxygen gas yields sulfur dioxide gas

Solid carbon reacts with oxygen gas to make carbon dioxide gas

Sodium metal reacts with chlorine gas to make sodium chloride solid

Calcium carbonate is heated to form carbon dioxide and calcium oxide

Methane ( $\text{CH}_4$ ) gas is burned in oxygen gas to produce carbon dioxide and water vapor

## Reaction Prediction

**Classes of Chemical Reactions****Combination (synthesis):**

- A) Metal oxides will react with water to form bases
- B) Some nonmetal oxides will react with water to form ternary acids
- C) Many elements will react with oxygen to form oxides
- D) Metals can combine with nonmetals to form ionic compounds

**Decomposition:**

- A) Metallic carbonates, when heated, form metal oxides, plus carbon dioxide
- B) Many metallic hydroxides, when heated, decompose into metallic oxides and water
- C) Metallic chlorates, when heated, decompose into metallic chlorides and oxygen
- D) Some acids, when heated, decompose into non—metallic oxides and water

E) Some oxides, when heated decompose

F) Some Decomposition reactions are produced by electricity

G) Ammonium salts decompose to give off ammonia gas

**Single Replacement:**

*Metal Replaces Metal*

*Non-metal replaces non-metal*

A) An active metal will replace hydrogen in water

B) A metal may replace hydrogen in an acid

C) A metal in a compound may be replaced by a more active metal

D) A halogen will replace a halogen below it in the Periodic Table

**Double Replacement:**

- A) An acid and a base will react to form a salt and water
- B) Two compounds may react to form a precipitate
- C) A metal oxide may react with an acid to form a salt and water
- D) Two compounds may react to form a gas

**Combustion:**

- A) Hydrocarbons can combust in oxygen to make carbon dioxide and water
- B) Metals can be burned in oxygen to produce oxides.
- C) Non-metals can be burned in oxygen to produce oxides

Exothermic Reactions

Endothermic Reactions

**Solutions and Precipitation Reactions**

What does it mean to be soluble?

What is the difference between dissolving and dissociating?

Why do substances dissolve?

What is the difference between a solute and a solvent?

What is a precipitate?

What is really present in a beaker full of NaCl in water?

Can you boil off the water and get the NaCl back?

What is really present in a beaker full of NaCl and AgNO<sub>3</sub> in water?

Can you boil off the water and get the NaCl and AgNO<sub>3</sub> back?

Table of Solubility Rules for Inorganic Compounds	
Soluble Compounds	Insoluble Compounds
compounds of Group 1 elements	carbonates ( $\text{CO}_3^{2-}$ ), chromates ( $\text{CrO}_4^{2-}$ ), oxalates ( $\text{C}_2\text{O}_4^{2-}$ ), and phosphates ( $\text{PO}_4^{3-}$ ), <u>except</u> those of the Group 1 elements and $\text{NH}_4^+$
ammonium ( $\text{NH}_4^+$ ) compounds	sulfides ( $\text{S}^{2-}$ ), <u>except</u> those of the Group 1 and Group 2 elements and $\text{NH}_4^+$
chlorides ( $\text{Cl}^-$ ), bromides ( $\text{Br}^-$ ), and iodides ( $\text{I}^-$ ), <u>except</u> those of $\text{Ag}^+$ , $\text{Hg}_2^{2+}$ , and $\text{Pb}^{2+*}$	hydroxides ( $\text{OH}^-$ ) and oxides ( $\text{O}^{2-}$ ), <u>except</u> those of the Group 1 and Group 2 elements <sup>†</sup>
nitrates ( $\text{NO}_3^-$ ), acetates ( $\text{C}_2\text{H}_3\text{O}_2^-$ ), chlorates ( $\text{ClO}_3^-$ ), and perchlorates ( $\text{ClO}_4^-$ )	
sulfates ( $\text{SO}_4^{2-}$ ), <u>except</u> those of $\text{Ca}^{2+}$ , $\text{Sr}^{2+}$ , $\text{Ba}^{2+}$ , $\text{Ag}^+$ , $\text{Hg}_2^{2+}$ , and $\text{Pb}^{2+‡}$	
<p>*<math>\text{PbCl}_2</math> is slightly soluble.  <sup>†</sup><math>\text{Ca}(\text{OH})_2</math> and <math>\text{Sr}(\text{OH})_2</math> are sparingly soluble; <math>\text{Mg}(\text{OH})_2</math> is only very slightly soluble.  <sup>‡</sup><math>\text{Ag}_2\text{SO}_4</math> is slightly soluble</p>	

Let's think about the last example:

First the molecular equation:

Second the complete ionic equation:

Finally the net ionic:

Another example:

