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 _____
$MgCl_2$	Mg _____
	Cl _____
$Mg(NO_3)_2$	
	Mg _____
	N _____
	O _____
$2NH_4NO_3$	
	H _____
	N _____
	O _____

Conservation of Atoms

Balance the following equations. No fractions!

1) ___H_2 + ___O_2 → ___ H_2O

2) ___K + ___O_2 → ___K_2O

3) ___Al + ___O_2 → ___Al_2O_3

4) ___Fe + ___Cl_2 → ___ Fe Cl_3

5) ___Na + ___Cl_2 → ___NaCl

6) ___Cr + ___S_8 → ___ Cr_2S_3

7) ___H_2 + ___N_2 → ___NH_3

8) ___Mg + ___HCl → ___$MgCl_2$ + ___H_2

9) ___HCl + ___NaOH → ___NaCl + ___H_2O

10) ___CCl_4 + ___HF → ___CCl_2F_2 + ___HCl

11) ___CH_4 + ___O_2 → ___CO_2 + ___H_2O

12) ___C_2H_6 + ___O_2 → ___CO_2 + ___H_2O

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 (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 $AgNO_3$ in water?

Can you boil off the water and get the NaCl and $AgNO_3$ back?

Table of Solubility Rules for Inorganic Compounds	
Soluble Compounds	Insoluble Compounds
compounds of Group 1 elements	carbonates (CO_3^{2-}), chromates (CrO_4^{2-}), oxalates ($C_2O_4^{2-}$), and phosphates (PO_4^{3-}), *except* those of the Group 1 elements and NH_4^+
ammonium (NH_4^+) compounds	sulfides (S^{2-}), *except* those of the Group 1 and Group 2 elements and NH_4^+
chlorides (Cl^-), bromides (Br^-), and iodides (I^-), *except* those of Ag^+, Hg_2^{2+}, and Pb^{2+}*	hydroxides (OH^-) and oxides (O^{2-}), *except* those of the Group 1 and Group 2 elements†
nitrates (NO_3^-), acetates ($C_2H_3O_2^-$), chlorates (ClO_3^-), and perchlorates (ClO_4^-)	
sulfates (SO_4^{2-}), *except* those of Ca^{2+}, Sr^{2+}, Ba^{2+}, Ag^+, Hg_2^{2+}, and Pb^{2+}‡	
*$PbCl_2$ is slightly soluble. †$Ca(OH)_2$ and $Sr(OH)_2$ are sparingly soluble; $Mg(OH)_2$ is only very slightly soluble. ‡Ag_2SO_4 is slightly soluble	

Let's think about the last example:

First the molecular equation:

Second the complete ionic equation:

Finally the net ionic:

Another example:

$BaCl_2(aq) + Na_2SO_4(aq) \rightarrow$