Unit 5 Study Guide Name: _____ Date: _____ Block:_____

1. What are indications of a chemical reaction?
   Color change, precipitate, gas production, energy
2. What are the six types of chemical reactions provide an example of each?

Decomposition: $2NaCl \rightarrow 2Na + Cl_2$ (always 1 reactant)

Synthesis/Combination: $2Mg + O_2 \rightarrow 2MgO$ (always 1 product)

Combustion: $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ (always CH compound & Oxygen to always produce CO_2 & H_2O)

Single Replacement: $Sr + 2\ AgCl \rightarrow SrCl_2 + Ag$ (activity series; metal replaces metal, nonmetal replaces nonmetal)

Double Replacement: $KCl + NaBr \rightarrow NaCl + KBr$ (two ionic compounds, metals switch places)

Acid-Base: $HCl + NaOH \rightarrow NaCl + HOH$ (acid (H 1st) and base (hydroxide present) to produce water and ionic compound)

3. Discuss the following:
   a. law of conservation of matter *: **matter cannot be created nor destroyed(total mass of reactants = total mass of products)***
   b. aqueous : ***soluble homogeneous mixture (a solution) in which cations and anions have separated in water***
   c. precipitate : ***insoluble; solids formed from two liquids***
   d. soluble vs insoluble : ***soluble= cations break apart from anions in water insoluble= solids formed***
   e. activity series : ***used to determine if an element is more reactive. It determines if a single replacement reaction will proceed or if it is a no reaction.***
   f. endothermic reaction : ***adding heat, absorbing heat, heat is needed, heat is on the reactant side, the enthalpy is positive***
   g. exothermic reaction : ***removing heat, heat is given off, heat is produced, heat is on the product side, the enthalpy is negative***
4. Determine the type of reaction, predict the products , and balance the reaction:
   a. $Ca + F_2 \rightarrow$ **CaF_2**
   b. **2**$Mg\ (s) + Co(NO_3)_2\ (aq) \rightarrow$ **$2MgNO_3 + Co$**
   c. $MgO +$ **2**$HCl \rightarrow$ **$MgCl_2 + H_2O$**
   d. $C_2H_6 +$ **5** $O_2 \rightarrow$ **$2CO_2 + 6\ H_2O$**
5. What is the net ionic reaction for the following: $(NH_4)_2S\ (aq) + Cd(NO_3)_2\ (aq) \rightarrow 2NH_4NO_3\ (?) + CdS\ (?)$

$(NH_4)_2S\ (aq) + Cd(NO_3)_2\ (aq) \rightarrow 2NH_4NO_3$ **(aq)** $+ CdS$ **(s)**

$2(\cancel{NH_4})\ (aq) + S\ (aq) + Cd(aq) + 2(\cancel{NO_3})\ (aq) \rightarrow 2\cancel{NH_4}\ (aq) + 2\cancel{NO_3}\ (aq) + Cd\ S\ (s)$

S (aq) + Cd(aq) → CdS (s)

6. How much of Chlorine gas is needed in grams to produce 0.75 moles of sodium chloride: $2Na + Cl_2 \rightarrow NaCl$

0.75 moles NaCl	**1 mole Cl_2**	**70.90 g Cl_2**
	1 mole NaCl	**1 mole Cl_2**

= 53.175 g Cl_2 = 53 g Cl_2

Mole ratio *Molar mass of Diatomic chlorine* *Round to 2 significant figures*

7. How much carbon dioxide is produced in liters assume STP when 25.0 g of calcium carbonate decomposes: $CaCO_3 \rightarrow CaO + CO_2$

25.0 g $CaCO_3$	**1 mole $CaCO_3$**	**1 mole CO_2**	**22.4L CO_2**
	100.09 g $CaCO_3$	**1 mole $CaCO_3$**	**1 mole CO_2**

= 5.59 L CO_2

Molar mass of Calcium carbonate *mole ratio* *molar volume only @ STP* ***Round to 3 significant figures***

8. What is the max amount of aluminum chloride produced in grams when 4.25×10^{22} atoms of aluminum react with 18.23 grams of chlorine gas? What is the limiting reactant? What is the excess reactant? What is the percent yield if 17.48 g of aluminum chloride is produced in lab? $2Al + 3Cl_2 \rightarrow 2AlCl_3$

4.25×10^{22} atoms Al	**1 mole Al**	**2 mole $AlCl_3$**	**133.33 g $AlCl_3$**
	6.02×10^{23} atoms Al	**2 mole Al**	**1 mole $AlCl_3$**

= 9.41 g $AlCl_3$

18.23 g Cl_2	**1 mole Cl_2**	**2 mole $AlCl_3$**	**133.33g $AlCl_3$**
	70.90g Cl_2	**3 mole Cl_2**	**1 mole $AlCl_3$**

= 22.85 g $AlCl_3$

Max amount (theoretical yield) = smallest answer of the two grids

Limiting reactant: **Aluminum**

Excess reactant: **Chlorine**

Actual / Theoretical **17.48 g / 9.41 g** **= 185.76 %**

Wow! Percent yield > 100%. There must be lots of experimental error.

Percent error = (17.48 g – 9.41 g) / 9.41 g x 100 = 85.76% error

9. How much energy is associated with this reaction when there is 4.00 grams of hydrogen reacts with excess carbon? $C(s) + 2H_2(g) \rightarrow CH_4(g) + 74.3\ kJ$

4.00 g H_2	**1 mole H_2**	**-74.3 kJ**
	2.02 g H_2	**2 mole H_2**

= -73.6 kJ

10. If 67.4 kJ is used in the reaction between hydrogen and carbon dioxide, how many liters of carbon monoxide can be produced at STP? $H_2(g) + CO_2(g) + 11\ kJ \rightarrow H_2O(g) + CO(g)$

67.4 kJ	**1 mole CO**	**22.4L CO**
	11 kJ	**1 mole CO**

= 137 L CO