Chapter 8 Review- 1

Types of Reactions

There are 5 major types of reactions simplified by the following equations:

- Synthesis/Combination $A + B \rightarrow AB$ *Remember that there are special cases*
- Decomposition $AB \rightarrow A + B$ *Remember that there are special cases*
- Combustion $CH + O_2 \rightarrow CO_2 + H_2O$
- Single Replacement $X + AB \rightarrow XB + A$ *or* $Y + AB \rightarrow AY + B$
  - *only occurs if single metal has a higher activity series.*
- Double Replacement $XY + AB \rightarrow XB + AY$

Activity series for single replacement reactions:

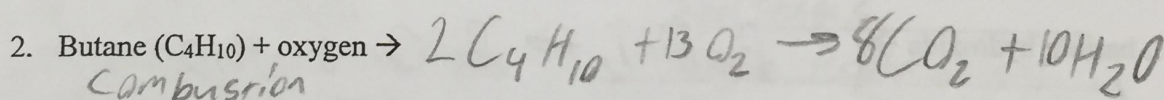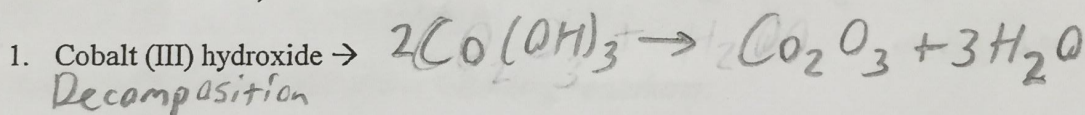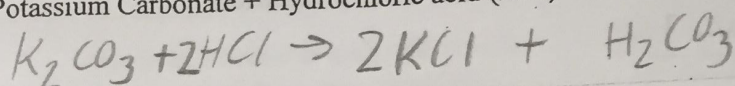| Reactivity Series of Metals			
	Potassium	K	(Most reactive metal)
	Sodium	Na	
	Calcium	Ca	
These metals are more reactive than hydrogen	Magnesium	Mg	
	Aluminium	Al	
	Zinc	Zn	
	Iron	Fe	
	Tin	Sn	
	Lead	Pb	
	[Hydrogen]	[H]	
	Copper	Cu	
These metals are less reactive than hydrogen	Mercury	Hg	
	Silver	Ag	
	Gold	Au	(Least reactive metal)

Finishing Reactions

TYPE

Complete the following by identifying the type of reaction AND properly writing formulas. Make sure your final answer is balanced. (HINT: double check to make sure the single replacements will work!)

Special case

1. Cobalt (III) hydroxide → $2Co(OH)_3 \rightarrow Co_2O_3 + 3H_2O$

   Decomposition

2. Butane (C_4H_{10}) + oxygen → $2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$

   Combustion

3. ~~lead (II) sulfate →~~ $SO_6 \rightarrow$

4. Potassium Carbonate + Hydrochloric acid (HCl) →

$$K_2CO_3 + 2HCl \rightarrow 2KCl + H_2CO_3$$

double Replacement

5. magnesium + Lithium Chloride → No Reaction
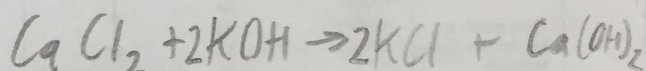
Single Replacement

Activity series

6. lead (II) + tin(II)nitrate → No Reaction

Single Replacement

7. zinc + sulfuric acid (H₂SO₄)→

$$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$$

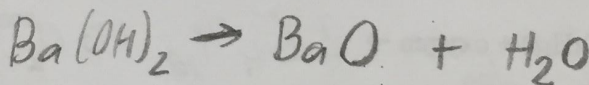Single Replacement

8. calcium chloride + potassium hydroxide →

$$CaCl_2 + 2KOH \rightarrow 2KCl + Ca(OH)_2$$

double Replacement

9. $C_6H_{12} + 9O_2 \rightarrow 6CO_2 + 6H_2O$

Combustion

Special case

10. barium hydroxide →

$$Ba(OH)_2 \rightarrow BaO + H_2O$$

decomposition

Special case

11. magnesium oxide + carbon dioxide →

$$MgO + CO_2 \rightarrow MgCO_3$$
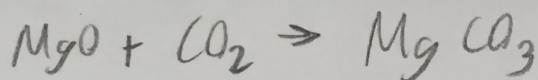
Synthesis

Chapter 8 Review- 2

Types of Reactions

There are 5 major types of reactions simplified by the following equations:

- Synthesis/Combination $A + B \rightarrow AB$ *Remember that there are special cases*
- Decomposition $AB \rightarrow A + B$ *Remember that there are special cases*
- Combustion $CH + O_2 \rightarrow CO_2 + H_2O$
- Single Replacement $X + AB \rightarrow XB + A$ *or* $Y + AB \rightarrow AY + B$
  - *only occurs if single metal has a higher activity series.*
- Double Replacement $XY + AB \rightarrow XB + AY$

Special Cases for Synthesis and Decomposition:
   Metal oxide + water → metal hydroxide
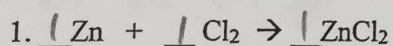   *Metal chloride and Oxygen → metal chlorate*
   Metal oxide and carbon dioxide → metal carbonate
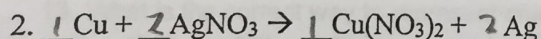   *Nonmetal oxide and water → Acid*

Activity series for single replacement reactions:

Reactivity Series of Metals			
	Potassium	K	(Most reactive metal)
	Sodium	Na	
	Calcium	Ca	
These metals are more reactive than hydrogen	Magnesium	Mg	
	Aluminium	Al	
	Zinc	Zn	
	Iron	Fe	
	Tin	Sn	
	Lead	Pb	
	[Hydrogen]	[H]	
	Copper	Cu	
These metals are less reactive than hydrogen	Mercury	Hg	
	Silver	Ag	
	Gold	Au	(Least reactive metal)

Classify and balance each of the following reactions:

1. __1__ Zn + __1__ Cl_2 → __1__ $ZnCl_2$ Synthesis.

2. __1__ Cu + __2__ $AgNO_3$ → __1__ $Cu(NO_3)_2$ + __2__ Ag   Single Replacement

3. __1__ $Mg(OH)_2$ → __1__ MgO + __1__ H_2O Decomposition (special case)
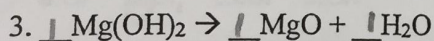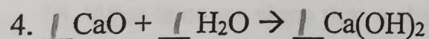
4. __1__ CaO + __1__ H_2O → __1__ $Ca(OH)_2$ Synthesis (special case)

Classify each of the following reactions when only the reactants are given:

1. $Mg + N_2 \rightarrow$ _____ Synthsis_____

2. $C_2H_6 + O_2 \rightarrow$ _____ Combustion_____
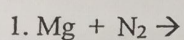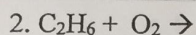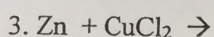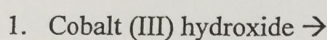
3. $Zn + CuCl_2 \rightarrow$ _____ Single Replacement_____
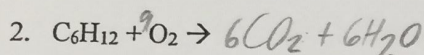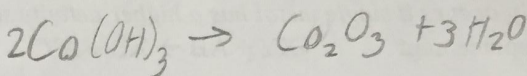
Finishing Reactions

TYPE

Complete the following by identifying the type of reaction AND properly writing formulas. Make sure your final answer is balanced. (HINT: double check to make sure the single replacements will work!)
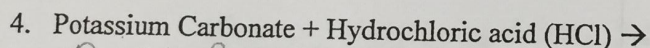
Special Case

1. Cobalt (III) hydroxide → $2Co(OH)_3 \rightarrow Co_2O_3 + 3H_2O$

   Decomposition

2. $C_6H_{12} + 9O_2 \rightarrow 6CO_2 + 6H_2O$

   Combustion

3. ~~lead (II) sulfate →~~

4. Potassium Carbonate + Hydrochloric acid (HCl) → $K_2CO_3 + 2HCl \rightarrow H_2CO_3 + 2KCl$

   Double Replacement

5. magnesium + Lithium Chloride → No Rxn

   Single Replacement

Activity series

6. lead (II) + tin(II)nitrate → No Rxn

   Single Replacement

B
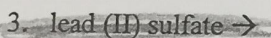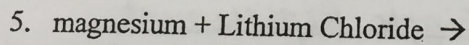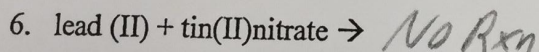
1. In a chemical reaction, (s) means which of the following?
   a. Liquid   b. Solid   c. Aqueous   d. Substance

D

2. In a chemical reaction, (aq) stands for what?
   a. Solid   b. Gas   c. Liquid   d. Aqueous

C

4. In a chemical reaction, (g) stands for what?
   a. gram   b. solid   c. gas   d. liquid

C

5. What are the coefficients? __Ca(OH)$_2$ + __NaCl Yields __CaCl$_2$ + __NaOH
   a. 1,2,2,1   b. 1,1,1,1   c. 1,2,1,2   d. 1,2,1,1

A

6. What is the Oxidation number of Potassium?
   a. +1   b. +2   c. -1   d. -2

D

7. What is the Oxidation number of Oxygen?
   a. +1   b. +2   c. -1   d. -2

A

8. What is the Oxidation number of Lithium?
   a. +1   b. +2   c. -1   d. -2

C

9. What is the Oxidation number of Fluorine?
   a. +1   b. +2   c. -1   d. -2

C

10. In order for a collision to occur what needs to be present?
    a. Sufficient Energy   b. Favorable Orientation
    c. Both sufficient energy and favorable orientation   d. None of the above

C

11. Which of the following is the correct formula for Calcium Nitrate?
    a. CaNO$_3$ b. CNO$_3$ c. Ca(NO$_3$)$_2$ d. Ca$_2$NO$_3$

D

12. What is the oxidation state of Br$_2$?
    a. -1   b. -2   c. +1   d. 0

B

13. What is the correct way to represent chlorine gas as a chemical formula?
    a. Cl   b. Cl$_2$ c. 2Cl   d. Ch

D

15. What is or are signs that a chemical reaction has occurred?
    a. Bubbles!   b. Precipitate forms   c. gas is produced   d. all of the above

B

16. What do we use to balance chemical equations?
    a. subscripts   b. coefficients   c. precipitates   d. soluble

C 17. what is a solid that is left over in a double replacement reaction?
a.aqueous solution   b.liquid   ⓒprecipitate   d.halogen

B 18. what reaction begins with one reactant and ends with two smaller products?
a.Synthesis   ⓑDecomposition   c.Single Replacement   d.Double Replacement

A 19. what reaction begins with two reactants and forms one larger product?
ⓐSynthesis   b.Decomposition   c.Single Replacement   d.Double Replacement

C 20. what reaction begins with an element and a compound and forms a compound with a lone element?
a.Synthesis   b.Decomposition   ⓒSingle Replacement   d.Double Replacement

D 21. what reaction begins with two compounds and forms two compounds?
a.Synthesis   b.Decomposition   c.Single Replacement   ⓓDouble Replacement

C 22. $Al + 3AgNO_3$ YIELDS $Al(NO_3)_3 + 3Ag$, is what kind of reaction?
a.Synthesis   b.Decomposition   ⓒSingle Replacement   d.Double Replacement

D 23. Fill in the Coefficients: ___CH_4 + ___O_2 Yields ___CO_2 + ___H_2O
a.1,1,1,1   b.1,2,2,1   c.1,2,1,1   ⓓ1,2,1,2

D 24. Fill in the Coefficients: ___$Pb(NO_3)_2$ + ___KCl Yields ___$PbCl_2$ + ___KNO_3
a.1,1,1,1   b.1,2,2,1   c.1,2,1,1   ⓓ1,2,1,2

A 25. What type of reaction deals with hydrocarbons (C_xH_y) reacting with O_2?
ⓐCombustion   b.Single Replacement   c.Synthesis   d.Decomposition

C 26. How many atoms of Oxygen are in the following compound? $2Fe(OH)_3$
a.1   b.3   ⓒ6   d.2

D 27. How many atoms of Hydrogen are in the following compound? $(NH_4)_3PO_4$
a.1   b.4   c.8   ⓓ12

B 28. What is the oxidation number of Iron in FeO ?
a.+1   ⓑ+2   c.+3   d.-2

C 29. What is the formula for Potassium Sulfite?
a.KSO_4 b.KSO_3 ⓒK_2SO_3 d.K_2SO_4

B 30. Predict the products: $Li + Zn(OH)_2$ ----->
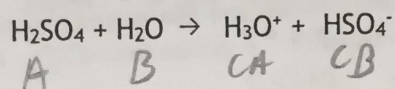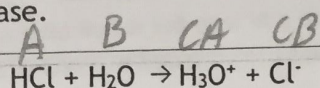a.$Li + Zn(OH)_2$ ⓑLiOH + Zn   c.$Zn + Li + H_2O$ d.$Li(OH)_2 + Zn$

Name_____ Date_____ Class_____
Chapter 15-16 Acid Base Review
pH: Acid and Bases:

1. Explain the pH scale? measures the Strength of an acid or Base
   a. What is an acid? pH less than 7   pH<7
   b. What is a base? pH greater than7   pH>7

2. Explain what will happen to the pH, when a strong acid is placed in a strong base? A neutralization reaction occurs and a salt and water is formed

3. What is the pH of a solution with a H^+ concentration of 1 x 10⁻³   pH=3

4. What is used to determine the pH of a solution? $[H^+]$

5. Phenophalthlein is an indicator which we used in lab, it turns pink in the presents of what pH?

6. A solution has a pH of 7 or is neutral when the H_3O^+ ion concentration =
   __OH⁻ concentration__

7. When an acid and a base react they produce __Salt__ and
   __Water__.

8. What composes an oxyacid? How are oxyacids named?
   Hydrogen + ion containing Oxygen   -ate → -ic   Acid
                                            -ite → ous

9. What makes a binary acid? How do you name binary acids?
   Hydrogen + ion without oxygen   Hydro - element - ic Acid

Provide either the name or the symbol for the following:

HNO_3 __Nitric Acid__ H_2SO_4 __Sulfuric Acid__

HI __Hydroiodic Acid__ H_3PO_3 __Phosphoric Acid__

Carbonic Acid __H_2CO_3__   Hydrochloric acid __HCl__

Nitric Acid __HNO_3__   Hydronitric acid __H_3N__

3. Identify the Browsted-Lowry acid and base along with the conjugate acid and base.

$$\underset{A}{HCl} + \underset{B}{H_2O} \rightarrow \underset{CA}{H_3O^+} + \underset{CB}{Cl^-}$$

$$\underset{A}{H_2SO_4} + \underset{B}{H_2O} \rightarrow \underset{CA}{H_3O^+} + \underset{CB}{HSO_4^-}$$

5. What is the relationship a strong acid and its conjugate base?

Strong acid becomes Very weak Conjugate Base

6. Which is the favored direction for the following reactions? Why?
   a. $HCl + H_2O \leftrightarrow Cl^- + H_3O^+$ Forwards HCl Strongest Acid
   b. $HF + H_2O \leftrightarrow F^- + H_3O^+$ Reverse H₃O⁺ stronger Acid
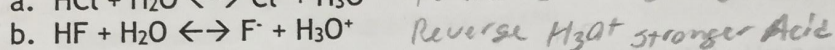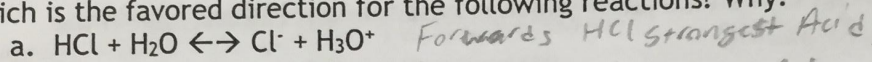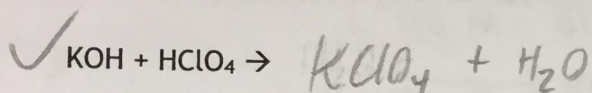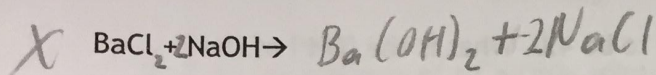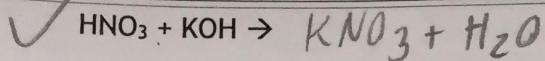
7. Label the following pH scale by placing numbers and the following words in their appropriate spot. Acid, base, neutral, strong base, strong acid, weak acid, weak base.

WB   SB   SA   WA

pH

WD

SA   WA | WB   SB

Neutral   Bases

Acids
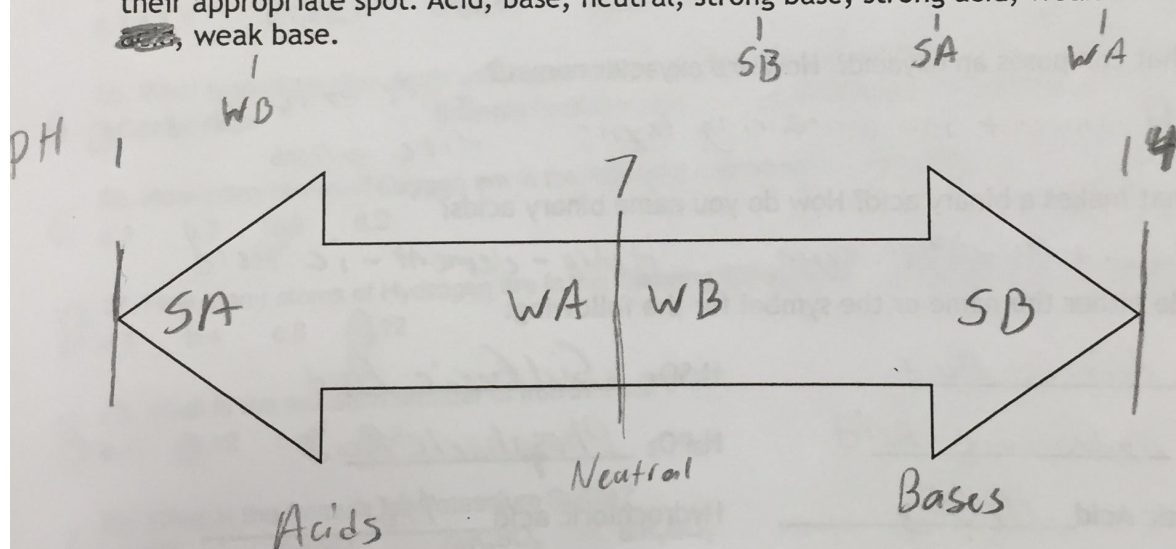
$Salt + H_2O$

8. What are the products of a neutralization reaction? Which of the following reactions are neutralization reactions? How do you know?

✓ $HNO_3 + KOH \rightarrow$ $KNO_3 + H_2O$

✗ $BaCl_2 + 2NaOH \rightarrow$ $Ba(OH)_2 + 2NaCl$

✓ $KOH + HClO_4 \rightarrow$ $KClO_4 + H_2O$

9. Define the following words.

Titrant- Known solution added to the analyte

Analyte- unknown solution to which the titrant is added

Midpoint/Equivalence point- when the solution is neutral. $[H_3O^+] = [OH^-]$

End point- when the color of the indicator changes

How is a titration used to find the concentration of the unknown solution?

Math Concepts in Chemistry: ACID/BASE REVIEW

1. What is the [H⁺] of a solution whose [OH⁻] is 9.31×10^{-2} M? 1.07×10^{-13} M

$$1 \times 10^{-14} = 9.31 \times 10^{-2} \cdot [H^+]$$

$$\boxed{1.07 \times 10^{-13} = [H^+]}$$

$\frac{14}{-4}$
$\overline{10\,pOH}$

2. The pH of a softdrink is determined to be 4.0. What is the [OH⁻] of the drink? 1.0×10^{-10} M

$$[OH^-] = 10^{-10} = \boxed{1 \times 10^{-10} \, M \, OH^-}$$

3. What is the [H⁺] of a solution whose pH = 5.43 ? 3.72×10^{-6} M

$$[H^+] = 10^{-5.43} = \boxed{3.72 \times 10^{-6} \, M \, H^+}$$

4. 10.0 mL of a solution of potassium hydroxide was titrated with a 0.10 M solution of hydrochloric acid. 13.5 mL of the acid was required for neutralization. Calculate the concentration of the potassium hydroxide solution.   0.14 M
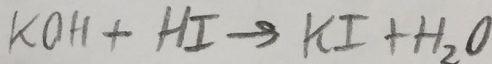
$$KOH + HCl \rightarrow KCl + H_2O$$
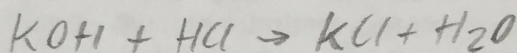
$$0.0135 L \times \frac{0.1 \, mol}{1 L} \times \frac{1 \, mol \, KOH}{1 \, mol \, HCl} = \frac{0.00135 \, mol}{0.01 L} = \boxed{0.135 \, M \, KOH}$$

5. What is the pH and pOH of a .005 M solution of H_2SO_4? pH-2 pOH-12

$$pH = -Log(0.01) = \boxed{2 \, pH} \quad \frac{\times 2}{0.01 \, M \, H^+}$$

$$pOH = 14 - 2 = \boxed{12 \, pOH}$$

6. How many moles of KOH are needed to neutralize 350 mL of a 4.5 M solution of HI? 1.575 moles

$$KOH + HI \rightarrow KI + H_2O$$

$$.350 L \times \frac{4.5 \, mol}{1 L} \times \frac{1 \, mol \, KOH}{1 \, mol \, HI} = \boxed{1.575 \, mol \, KOH}$$

$x_2 = 0.035M \, aH^-$

7. In a titration, 12.5 mL sample of 1.75 x 10^{-2} M Ba(OH)$_2$ just neutralized 14.5 mL of HNO$_3$. Calculate the molarity of the HNO$_3$ solution. _____ M

$$Ba(OH)_2 + 2HNO_3 \rightarrow Ba(NO_3)_2 + 2H_2O$$
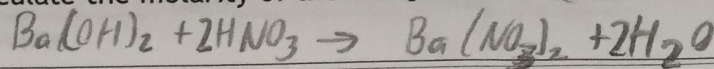
$.0125 \times \dfrac{0.035 mol}{1L} \times \dfrac{2 mol HNO_3}{1 mol Ba(OH)_2} = \dfrac{8.75 \times 10^{-4} mol \, HNO_3}{0.0145L} = \boxed{0.0603 M \\ HNO_3}$

8. Find the molarity of a Ca(OH)$_2$ solution, given that 428 mL if it is neutralized in a titration by 115 mL of .0067 M HNO$_3$. .0009 M
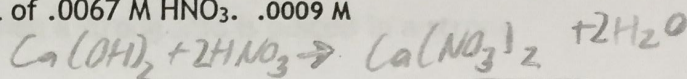
$.115 \times \dfrac{0.0067 mol}{1L} \times \dfrac{1 mol Ca(OH)_2}{2 mol HNO_3} = 3.853 \times 10^{-4} mol$

$$Ca(OH)_2 + 2HNO_3 \rightarrow Ca(NO_3)_2 + 2H_2O$$

$\dfrac{}{.428L} = \boxed{9.00 \times 10^{-4} M \, Ca(OH)_2}$

9. Why is water neutral?

It has equal concentrations of

H_3O^+ and OH^- concentrations.