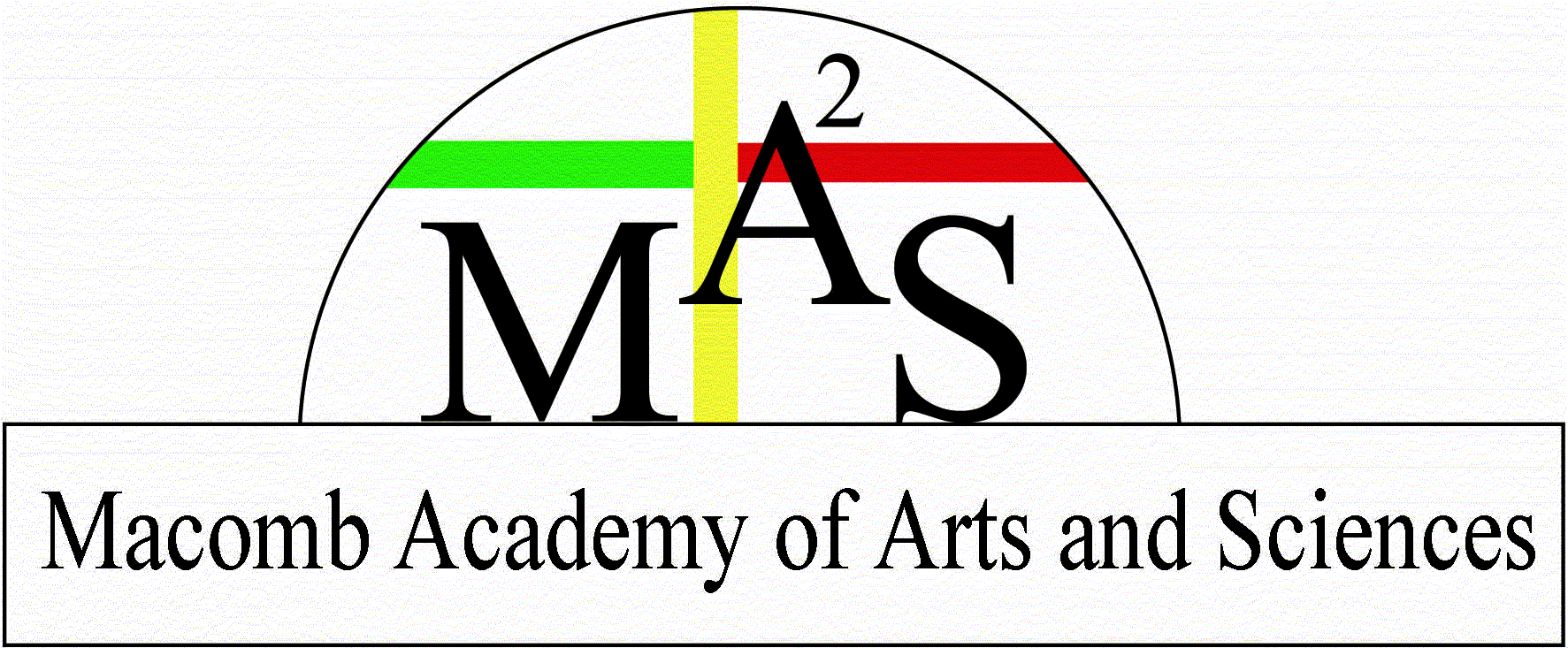
AP Chemistry

Summer

Prerequisite Review

ANSWER KEY



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Adapted from: Bergmann-Sams

DUE JULY 1

PART A. COMPOUNDS AND EQUATIONS

**Balancing Ionic Compounds**

***Given the names of the elements that form a compound, determine their ionic charge and write the chemical symbols for the compound.***

EX: Lithium Oxygen

Li2O Li+ O2-

1. Sodium Sulfur

Na+ S2-

Na2S

1. Potassium Chlorine

K+ Cl-

KCl

1. Rubidium Sulfate

Rb+ SO42-

Rb2SO4

1. Magnesium Nitrite

Mg2+ NO2-

Mg(NO2)2

1. Strontium Iodine

Sr2+ I-

SrI2

1. Aluminum Perchlorate

Al3+ ClO4-

Al(ClO4)3

1. Ammonium Phosphate

NH4+ PO43-

(NH4)PO4

1. Hydronium Bromine

H3O+ Br-

H3OBr

1. Cupric Carbonate

Cu2+ CO32-

CuCO­3

1. Iron (II) Iodate

Fe2+ IO3-

Fe(IO3­)2

1. Ferrous hydroxide

Fe2+ OH-

Fe(OH)2

1. Ferric Nitrate

Fe3+ NO3-

Fe(NO3)3

***Given chemical symbols below, determine the ionic charges of each element and then write the balanced chemical symbol for each compound formed.***

**EX:** Na ClO3Na2CO3

1. H Pb2+

H­2Pb

1. Li NO3

LiNO3

1. Be CO3

BeCO3

1. H SO3

H2SO3

1. Ca N

Ca3N2

1. Cs Br

CsBr

1. Fe3+ F

FeF3

1. Ag+ Se

Ag2Se

**Naming Ionic Compounds**

For each ionic compound, list the cation(s), anion(s), chemical formula, and electron dot structure

1. sodium iodide Chemical Formula Electron Dot Structure

cations \_\_\_\_\_Na\_\_\_\_\_\_\_

NaI

anions \_\_\_\_\_I\_\_\_\_\_\_\_\_

1. magnesium chloride Chemical Formula Electron Dot Structure

cations \_\_\_\_Mg2+\_\_\_\_\_\_\_

MgCl2

anions \_\_\_\_Cl-\_\_\_\_\_\_\_\_

1. aluminum sulfide Chemical Formula Electron Dot Structure

cations \_\_\_\_Al3+\_\_\_\_\_\_\_\_

Al2S3

anions \_\_\_\_\_S2-\_\_\_\_\_\_

1. iron (III) oxide Chemical Formula Electron Dot Structure

cations \_\_\_\_\_Fe3+\_\_\_\_\_\_\_

Fe2O3

anions \_\_\_\_\_\_O2-\_\_\_\_\_\_

1. stannous bromide Chemical Formula Electron Dot Structure

cations \_\_\_\_\_Sn2+\_\_\_\_\_\_\_\_\_

SnBr2

anions \_\_\_\_\_Br-\_\_\_\_\_\_\_

1. plumbic oxide Chemical Formula Electron Dot Structure

cations \_\_\_\_Pb2+\_\_\_\_\_\_\_\_

PbO

anions \_\_\_\_O2- \_\_\_\_

**Balance Chemical Reactions**

***Rewrite each chemical equation with the correct coefficients necessary to balance the equation.***

1. NaCO3(aq) + Ca(OH)­ (aq) 🡪 \_\_\_\_\_ NaOH(aq) + \_\_\_\_\_ CaCO3(s)

Na­2CO3(aq) + Ca(OH)­2 (aq) 🡪 \_\_\_2\_ NaOH(aq) + \_\_\_\_\_ CaCO3(s)

1. KPO4(aq) + \_\_\_\_\_ MgCl(aq) 🡪 \_\_\_\_\_ Mg(PO4) (s) + \_\_\_\_\_ KCl (aq)

2 K­­3PO4(aq) + \_\_\_3\_ MgCl2(aq) 🡪 \_\_\_\_\_ Mg3(PO4)2 (s) + \_\_\_6\_ KCl (aq)

1. Cu (s) + \_\_\_\_ H2SO4 (aq) 🡪 \_\_\_\_ CuSO4 (aq) + \_\_\_\_ H2O (l) + \_\_\_\_ SO2 (g)

Cu (s) + \_\_2\_\_ H2SO4 (aq) 🡪 \_\_\_\_ CuSO4 (aq) + \_\_\_2\_ H2O (l) + \_\_\_\_ SO2 (g)

1. FeS (s) + HCl (aq) 🡪 FeCl (aq) + HS (g)

FeS (s) + 2 HCl (aq) 🡪 FeCl2(aq) + H2S (g)

1. Fe (s) + CuNO3 (aq) 🡪 Cu (s) + Fe(NO3) (aq)

Fe (s) + 2 CuNO3 (aq) 🡪 2 Cu (s) + Fe(NO3)2 (aq)

1. KI (aq) + Cl2 (g) 🡪 KCl (aq) +I2 (aq)

2KI (aq) + Cl2 (g) 🡪 2 KCl (aq) + I2 (aq)

1. Al (s) + S (s) 🡪 AlS (s)

2Al (s) + 3 S (s) 🡪 Al­2S­3(s)

**Reaction Types**

***This is an instructional sheet to help you understand chemical reactions and to be able to predict the products of chemical reactions.***

There are 5 types of reactions in chemistry.

1. Combustion
   1. The combustion of an organic material
      1. EX: C3H8 + 5O2 🡪 3CO2 + 4H2O
      2. The products are always carbon dioxide and water. The only thing that changes is the organic material and the coefficients needed to balance the equation.
2. Combination
   1. A + B 🡪 X
   2. EX: 2Mg + O2 🡪 2MgO
3. Single-Replacement
   1. Use the Activity Series to determine if an elemental metal will replace the metal in a compound based upon the reactivity of the metals
      1. EX: Fe + 2AgNO3 🡪 Fe(NO3)2 + 2Ag
      2. EX: Cu + Zn(NO3)2 🡪 X or NR
4. Double-Replacement
   1. The cations of two ionic compounds exchange anionic partners
      1. EX: NaOH + HCl 🡪 NaCl + HOH
5. Decomposition
   1. The opposite of a combination reaction
   2. A compound decomposes into elements and compounds
   3. Typical products include CO2, H2, O2
      1. EX: BaCO3 🡪 BaO + CO2
      2. 2Zn(OH)2 🡪 2ZnO + 2H2
      3. Ni(ClO4)2 🡪 NiCl2 + 8O2
   4. ­There are tests for each type of product formed

***Predict the products. Identify the reaction type.***

**ALWAYS balance the equation.**

1. Zn2+ + Ca(OH)2 🡪 Ca + Zn(OH)2

Single replacement

1. LiCl + KBrO3 🡪 LiBrO3 + KCl

Double replacement

1. 2C2H6 + 7O2 🡪 4CO2 + 6H2O

combustion

1. 2 MgO + Δ 🡪 2 Mg + O2

decomposition

1. 2 Hydrogen + Oxygen 🡪 2H2O

combination

**Balance and Identify Chemical Reactions**

***Balance each equation with coefficients (all componds should already be balanced) and identify the reaction type.***

1. 2Hf + 2N2 🡪 Hf2N4

combination

1. Mg + H2SO4 🡪 MgSO4 + H2

Single replacement

1. 2C2H6 + 7O2 🡪 4CO2 + 6H2O

combustion

1. Pb(NO3)2 + 2 NaI 🡪 PbI2 + 2 NaNO3

Double replacement

1. 3Fe + 2O2 🡪 Fe3O­4

combination

1. 2Pb(NO3)2 🡪 2PbO + 4NO2 + O2

decomposition

1. Hg(NO3)2  + 2NH4SCN 🡪 Hg(SCN)2 + 2NH4NO3

Double replacement

1. (NH4)2SO4 + 2NaOH 🡪 2NH3 + 2H2O + Na2SO4

Decomposition or Double Replacement

***Predict the products, balance, and identify the type of reaction***

1. Al + H2SO4 🡪 H2 + Al2(SO4)3

Single replacement

1. 2HCl + Ba(OH)­2 🡪 2H2O + BaCl2

Double replacement

1. 2Au + 2HCl 🡪 2AuCl + H2

Single Replacement

**Decomposition and Synthesis Reactions**

***A synthesis reaction is the opposite of a decomposition reaction. This practice will help us recognize the products for common decomposition reactions***

1. Sodium + Oxygen

4Na + O2 🡪 2Na2O

1. Lithium + Sodium chloride

Li + NaCl 🡪 LiCl + Na

1. Sodium chloride and heat

NaCl + heat 🡪 Na + Cl2

1. Potassium chlorate

2KClO3­ + heat 🡪 2KCl + 3O2

1. Copper (II) + Oxygen

2Cu + O2 🡪 2CuO

1. Aluminum + Hydrogen chloride

2Al + 6HCl 🡪 3H2 + 2AlCl3

1. Magnesium + Oxygen

2Mg + O2 🡪 2MgO

1. Silver + Chlorine

2Ag + Cl2 🡪 2AgCl

1. Aluminum oxide and heat

2Al2O3 + heat 🡪 4Al + 3O2

DUE AUGUST 1

PART B. STOICHIOMETRY

**Stoichiometry Worksheet:** **Molecule to Mass/Mole**

1. How many molecules are there in 24 grams of FeF3?

1.28x1023molecules FeF3

1. How many molecules are there in 450 grams of Na2SO4?

1.91x1024 molecules Na2SO4

1. How many grams are there in 2.3 x 1024 atoms of silver?

411.9 g Ag

1. How many grams are there in 7.4 x 1023 molecules of AgNO3?

208.8 g AgNO3

1. How many grams are there in 7.5 x 1023 molecules of H2SO4?

122.1 g H2SO4

1. How many molecules are there in 122 grams of Cu(NO­3)2?

3.92x1023 molecules Cu(NO3)2

1. How many grams are there in 9.4 x 1025 molecules of H2?

312.3 g H2

1. How many molecules are there in 230 grams of CoCl2?

## 1.06x1024 CoCl2

## Stoichiometry Worksheet: Moles and Moles

1. Carbon disulfide is an important industrial solvent. It is prepared by the reaction of coke with sulfur dioxide:

**5C(s) + 2SO2(g) -----> CS2(s) + 4CO(g)**

* 1. How many moles of CS2 form when 6.3 mol of C reacts? **THIS EXAMPLE IS DONE FOR YOU!**

6.3mol C 1 mol CS2 = 1.26 mol CS2

5 mol C

1. How many moles of carbon are needed to react with 7.24 moles of SO2

18.1 mol C

1. Silver can be made according to the following equation:

**2AgNO3+ Ca 🡪 Ca(NO3)2 + 2Ag**

* 1. Balance the equation
  2. Identify the type of reaction Single Replacement
  3. If 35.3 moles of silver nitrate are reacted how many moles of silver are produced?

35.3 mol Ag

1. How many moles of carbon dioxide are formed when 44-mol of CH4 is burned?

44 mol CO2

1. How many moles of calcium phosphate is formed when 32.5-mols of calcium nitrate reacts with sodium phosphate?



## Stoichiometry Worksheet: Moles and Moles

1. Car batteries are called lead storage batteries because of their use of large quantities of lead. These batteries utilize the following equation.

**Pb + PbO2 +2H+ + 2HSO4- 🡪 2PbSO4 + 2 H2O**



1. 32.5-g of ZnSO4 reacts to form how many grams of BaSO4 according to the following equation.
   1. Balance the equation
   2. Identify the type of reaction

****

1. When sodium metal is added to water the resulting gas, Hydrogen can often explode. How many Liters of hydrogen gas is produced when 41.2-g of sodium is dropped into water. You must balance the equation in order to solve the problem.

**Na + HOH 🡪 NaOH + H2**

****

1. 43.5-grams of barium sulfate is formed from the reaction of barium nitrate and sodium sulfate. How many moles of sodium sulfate reacted?

**Stoichiometry Worksheet: Volume**

1. Barium oxide reacts with carbon dioxide to make Barium carbonate:

**BaO + CO2 🡪 BaCO3**

* 1. Balance the equation
  2. Identify the type of reaction **Single Replacement**
  3. If 23.4 moles of barium oxide react, how many liters of CO2 are required at STP?



1. Ammonia, (NH3) is produced by reacting its elements with each other according to the following equation:

**N2 + 3H2 🡪 2NH3**

* 1. Balance the equation
  2. Identify the type of reaction Combination
  3. If 34.3-L of nitrogen is reacted with hydrogen, how many liters at STP of ammonia will be formed?



1. Calculate the volume of carbon dioxide produced when 250 g of pentane, C5H12, burn. Assume the carbon dioxide is cooled to STP.



1. Propane is a gas used often for backyard grills. How many Liters of CO2 is produced when 54.9-L of propane (C3H8) is burned according to the following equation. Again, you must balance the equation in order to solve the problem.

**C3H8 + O2 🡪 CO2 + H2O**

****

**Stoichiometry Worksheet: Grams**

1. 14.5-g of cesium explosively reacts with water to form hydrogen and cesium hydroxide. How many molecules of hydrogen were formed?



1. How many molecules of chlorine are needed to react with 5.6 g of iron to form iron III chloride?



1. What mass of ammonia, NH3, is necessary to react with 2.1 x 1024 molecules of oxygen when ammonia (NH3) reacts with oxygen to form water and nitrogen dioxide?



1. 22.8-g of NaOH is reacted with hydrochloric acid. How many grams of water is formed?



1. 32.5-grams of iron III chloride reacts with silver nitrate. How many grams of silver chloride are formed?



**Stoichiometry Worksheet: Grams**

1. 34.5-grams of Lithium reacts with Chromium III chloride. How many grams of lithium chloride is formed?



1. 43.5-grams of copper II sulfate is reacted with barium nitrate. How many grams of precipitate are formed?
2. Calculate the mass of silver needed to react with chlorine to produce 84 g of silver chloride.



1. Silver nitrate reacts with sodium chloride to make the silver chloride and sodium nitrate. When 2.53 grams of silver nitrate is reacted. How many grams of silver chloride are formed?



1. When 3.25 g of copper II nitrate reacts with ammonium hydroxide. How many grams of the precipitate will form?



**Stoichiometry Worksheet: Limiting Reactants**

1. When 114.0 g of iron and 292.7 g of chlorine gas reacts, iron(III) chloride is formed.



2. 20 L of oxygen react with 1.0L of methyl alcohol, CH3OH.



**Stoichiometry Worksheet: Limiting Reactants**

3. 25 g of hydrazine, N2H4(l), and 66 g of hydrogen peroxide, H2O2(l), react to produce nitrogen gas and water.



4. 22.5 grams of lithium reacts with 33.5 grams of aqueous aluminum sulfate. This is a single replacement reaction.



**Stoichiometry Worksheet: Percent Yield**

1. 15.5-g of NH4Cl reacts with an excess of AgNO3. In the reaction 35.5-g AgCl is produced. NH4NO3 is the other product. What is the percent yield?



2. Potassium Chlorate decomposes according to the following reaction.

**2KClO3 🡪 2KCl +3 O2**

1. In an experiment 32.5-g of KClO3 is decomposed and 15.2-g of KCl is formed. What is the percent yield?



3. Nitrogen gas reacts with hydrogen gas to make ammonia (NH3). 15.5-L of N2 reacts at STP to make 30-L of ammonia. What is the percent yield?



1. What is the percent yield of oxygen gas if 54L of O2 can be obtained from the thermal decomposition of 500.0 g of potassium chlorate?

KClO3 → KCl + O2



**Stoichiometry Worksheet: Mixed Problems**

1. How many grams of water are formed when 12.5-g of hydrogen reacts with oxygen?



2. How many liters of carbon dioxide are formed when 12.3-g of sodium carbonate reacts with 2.0-L of hydrogen chloride. The reaction is printed below:

**Na2CO3 + HCl 🡪 NaCl + H2O + CO2**



1. How many grams of precipitate are formed when 24.3-g of zinc nitrate reacts with 20.5-g of sodium phosphate?



4. How many liters of oxygen are produced when 3.25-g of KClO3 decomposes into KCl and O2?

