IB Chemistry II HL/SL Summer Assignment

Name:

The purpose of this summer assignment is to reacquaint you with some of the topics from IB Chemistry I that are core to the course. We will not spend a lot of time on these topics. **Completion of this assignment is optional, however there will be a test on the material during the first month of school so completion is strongly recommended.** **Please print a copy of this assignment and fill in all the information in a neat and legible manner. If you have to do rough work, do it on a separate piece of paper and then transfer your work and answers to this packet.** **The estimated time to complete this packet approximately three hours. Resources for help are available on the last page of this assignment. Also, a key will be posted to blackboard during the first week of school to check your work. If you have questions, please feel free to email me:**

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I. Chemical Nomenclature: Remember that when we name compounds, we first must determine whether the compound is ionic or covalent.

Ionic compounds follow the general formula: *Metal name nonmetal-ide*

If the metal is a transition metal or any other metal under the stair case (Exceptions- Al, Zn, Ag) , we use a Roman numeral after the metal name to indicate its charge, or oxidation state. Examples of both are below:

NaCl= sodium chloride Fe_2O_3= iron (III) oxide

You also need to be able to use the following **polyatomic ions** in ionic compounds:

OH^- = hydroxide CO_3^{-2} = carbonate CH_3COO^- (or $C_2H_3O_2^-$) = acetate

NO_3^- = nitrate PO_4^{-3} = phosphate

SO_4^{-2} = sulfate NH_4^+ = ammonium

Covalent compounds cannot be named in the same way due to law of multiple proportions. For example, if I said "carbon oxide", you wouldn't know whether I meant CO or CO_2. So, we use Greek prefixes (mono, di, tri, tetra, penta, hexa, hepta, octa, nona, and deca) to indicate the number of each type of atom. We do not use mono for the first element. Examples:

N_2O_5= dinitrogen pentoxide SO_2= sulfur dioxide

Practice: Fill the table with correct answers **(40 Points)**

Formula	Name	Name	Formula
EX: $Al_3(PO_4)_2$	Aluminum phosphate	EX: Manganese(IV)oxide	MnO_2
K_2SO_4		Aluminum nitride	
N_3F_7		Lithium oxide	
P_2O_5		Phosphorous pentabromide	
$CuCl_2$		Dichlorine heptoxide	
SO_2		Silver chloride	
BaF_2		Calcium carbonate	
$Mg(OH)_2$		Nickel (II) sulfide	
$AgNO_3$		Tin (IV) hydroxide	

CCl_4		Trisilicon tetranitride	
Mg_3N_2		Potassium phosphate	
$NaCH_3COO$		Diphosphorus heptoxide	
$SiCl_4$		Chromium (II) bromide	
N_2O_5		Calcium nitrate	
$CoCl_2$		Nickel (II) oxide	
CO_2		Aluminum phosphide	
CaI_2		Lithium sulfide	
$Be(OH)_2$		Nitrogen pentafluoride	
$Sn(NO_3)_2$		Aluminum hydroxide	
P_2F_3		Trisilicon tetranitride	
Mg_3P_2		Potassium phosphate	

II. Chemical Reactions

You also need to recall that there are five major types of reactions: synthesis (S), decomposition (D), single replacement (SR), double replacement (DR), and combustion (C). We will work with all of these throughout the course, and it is important that you know how to predict the products of a chemical reaction given starting materials. One of the most important things to recall is that when you write an ionic compound, the subscripts are determined by the ion charge. For example:
$Na + Cl_2 \rightarrow NaCl_2$ is INCORRECT, because it does not take into account that the charge of sodium is +1, and the charge of chloride is -1. Therefore, the correct product would be: $2Na + Cl_2 \rightarrow 2NaCl$

We balance the equation to equalize the number of atoms of each type on each side of the equation. This holds true for any ionic compound. Take the double replacement reaction between silver nitrate ($AgNO_3$) and barium hydroxide:

INCORRECT: $AgNO_3 + Ba(OH)_2 \rightarrow Ag(OH)_2 + BaNO_3$

This is incorrect because it does not take into account the ion charges.

CORRECT: $2AgNO_3 + Ba(OH)_2 \rightarrow 2AgOH + Ba(NO_3)_2$

***Note: later in the course we will concern ourselves with state symbols and solubility rules; this is not needed yet.* Recall that all **combustion reactions** involve a hydrocarbon reacting with oxygen to produce carbon dioxide and water vapor. (Tip: When you balance a combustion reaction please balance oxygen at the end)

Practice: For each of the following reactions, identify the type, predict the products and balance the equation. Assume all reactions occur. **You DO NOT need to balance problems 16-20. (40 pts)**

S.No.	Reactants	Products	Type
Ex:	$Al_2(SO_4) + 3Ba \rightarrow$	$3BaSO_4 + 2Al$	SR
1.	$Ag_2O \rightarrow$		
2.	$C_4H_8 + O_2 \rightarrow$		
3.	$Al + N_2 \rightarrow$		
4.	$Cu + ZnSO_4 \rightarrow$		
5.	$Pb(NO_3)_2 + K_2SO_4 \rightarrow$		
6.	$Li + O_2 \rightarrow$		
7.	$Al_2(SO_4)_3 + Ba(OH)_2 \rightarrow$		
8.	$Ca + CuCO_3 \rightarrow$		
9.	$C_3H_6 + O_2 \rightarrow$		
10.	$Na_3PO_4 + Pb(NO3)_2 \rightarrow$		
11.	$Ag_2SO_4 + AlCl_3 \rightarrow$		
12.	$CdBr_2 + Na_2S \rightarrow$		
13.	$Pb(NO_3)_2 + NaI \rightarrow$		
14.	$NaOH + Fe(NO_3)_3 \rightarrow$		
15.	$NaNO_3 + BaCl_2 \rightarrow$		
16.	Sulfuric acid reacts with sodium hydroxide		
17.	Iron(II)chloride reacts with magnesium		
18.	Potassium bromide reacts with calcium oxide		
19.	Rubidium reacts with sulfur		
20.	Diphosphorus pentaoxide decomposes		

III. Stoichiometry (40 pts)

I expect that you will enter this class with a grasp of the fundamentals of stoichiometry. We will spend one class period reviewing gas-specific stoichiometry (including the concept of molar volume) and one class working on problems with limiting reactants. If you need extra help recalling some of the other material, I will be happy to help! I also expect that you will use DIMENSIONAL ANALYSIS (aka "the fence") in my class. If you did not learn this method, I will work with you to solve problems this way. The steps to using dimensional analysis as well as some worked examples are given below.

Mole conversions: Complete each of the following problems. CIRCLE YOUR FINAL ANSWER!! Be sure to include units and show all work!! **(4pts each)**

EX: Find the mass (in grams) of 3.65 x 10^{-2} mol potassium carbonate

$$\frac{3.65 \times 10^{-2}\ \text{mol } K_2CO_3}{1} \times \frac{126\ \text{g } K_2CO_3}{1\ \text{mole } K_2CO_3} = 4.60\ \text{g } K_2CO_3$$

EX: How many particles of chlorine molecules are present in 50.0g of Chlorine?

$$\frac{50.0\ \text{grams } Cl_2}{1} \times \frac{1\ \text{mole } Cl_2}{71.0\ \text{grams } Cl_2} \times \frac{6.02 \times 10^{23}\ \text{molecules } SO_2}{1\ \text{mole } Cl_2} = 4.24 \times 10^{23}\ \text{molecules } Cl_2$$

1. Convert 9.3 x 10^{15} atoms of lead to moles of lead.

2. Mass of 1.906 x 10^{-2} mol BaI_2

3. Number of O atoms in 4.88 x 10^{-3} mol $Al(NO_3)_3$

4. Find the number of atoms in 45.6 g of sulfur.

Stoichiometry: Complete each of the following problems. CIRCLE YOUR FINAL ANSWER!! Be sure to include units and show all work!! **(4 pts each)**

EX: To produce 12 moles of water, how many moles of oxygen gas are needed?

$$2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$$

$$\frac{12\ \text{mole } H_2O}{1} \times \frac{7\ \text{mole } O_2}{6\ \text{mole } H_2O} = 14\ \text{mole } O_2$$

EX: If 0.600 gram of zinc is used, how many grams of zinc chloride will be produced in the above reaction?

$$Zn + 2HCl \rightarrow ZnCl_2 + H_2$$

$$\frac{0.0600\ \text{grams Zn}}{1} \times \frac{1\ \text{mole Zn}}{65\ \text{grams Zn}} \times \frac{1\ \text{mole } ZnCl_2}{1\ \text{mole Zn}} \times \frac{136\ \text{grams } ZnCl_2}{1\ \text{mole } ZnCl_2} = 1.255\ \text{grams } ZnCl_2$$

5. Carbon dioxide is released into the atmosphere through the combustion of octane (C_8H_{18}) in gasoline. Calculate the mass of octane needed to release 5.00 mol CO_2.

$2\ C_8H_{18} + 25\ O_2 \rightarrow 16\ CO_2 + 18\ H_2O$

6. Calculate the mass of oxygen produced from the decomposition of 75.0 g of potassium chlorate.
$2\ KClO_3 \rightarrow 2\ KCl + 3\ O_2$

7. Calculate the mass of chlorine gas needed to react with 84.0 grams of aluminum to produce aluminum chloride. ***Write a balanced chemical equation first!***

8. An iron ore sample contains iron (III) oxide. It reacts with CO to produce iron metal. Calculate the number of grams of CO needed to react with 0.150 kg of iron (III) oxide. **Note: balance the equation first!!* $Fe_2O_3 + CO \rightarrow Fe + CO_2$

Limiting and excess reactant (8 pts)

9. What mass of "laughing gas" (dinitrogen monoxide) will be produced from 50 g of nitrogen gas and 75 g of oxygen gas? (Hint: Two stoichiometry problems in one question)
$2N_2 + O_2 \rightarrow 2N_2O$

Helpful Resources:

1. Mrs. Wiseman's IB Chem (great site with video tutorials and extra practice!):
   http://www.mwiseman.com/courses/chem_ib/
2. Chem I textbook online:
   www.chemistrymc.com , then click online student textbook full version and enter password BAC17E706D
3. Helpful videos:
   Naming ionic compounds
   https://www.youtube.com/watch?v=mKo72RnN37E
   Naming Molecular (Covalently Bonded) Compounds
   https://www.youtube.com/watch?v=DejkvR4pvRw
   Stoichiometry:
   https://www.youtube.com/watch?v=SjQG3rKSZUQ
4. Your chem. I notes…you still have them…right?? ☺