AP Chemistry Summer Assignment

Name _____ Date _____ Class Period _____

This is the summer packet for AP Chemistry. In this packet are links to eight (8) YouTube videos lectures, each about 20-25 mintues, for you to watch and Worksheet Guides with practice problems to work on.

I would expect each assignment to take about an hour to an hour and a half to complete and we'll be going over the assignments the first few weeks of school.

Know that a lot of this information is background information that will be useful to know when we start the class in August.

You may print out the following Worksheet Guides and fill them out by hand or use a program such as Kami to do your work.

Please email me if you have any issues or questions: npatla@centralcatholichigh.org

Good luck and see you in August!

Mr. Patla

Video #1: AP Chemistry Class & Test

A link to the YouTube video lecture can be found HERE.

Video #2: Nomenclature

A link to the YouTube video lecture can be found HERE (and the PDF of the lecture HERE).

Scroll down in this document to find the Worksheet Guide for this section.

Video #3: Solubility & Balancing & Net Ionic Formulas

A link to the YouTube video lecture can be found HERE (and the PDF of the lecture HERE).

Scroll down in this document to find the Worksheet Guide for this section.

Note: *I forgot to include answers on the PPT for the last two practice problems, but you can find them on the end of the PDF lecture above. Whoops.*

Video #4: Molar Conversions

A link to the YouTube video lecture can be found HERE (and the PDF of the lecture HERE).

Scroll down in this document to find the Worksheet Guide for this section.

Video #5: Stoichiometry

A link to the YouTube video lecture can be found HERE (and the PDF of the lecture HERE).

Scroll down in this document to find the Worksheet Guide for this section.

Video #6: Limiting Reactants

A link to the YouTube video lecture can be found HERE (and the PDF of the lecture HERE).

Scroll down in this document to find the Worksheet Guide for this section.

Video #7: Empirical Formulas

A link to the YouTube video lecture can be found HERE (and the PDF of the lecture HERE).

Scroll down in this document to find the Worksheet Guide for this section.

Video #8: Combustion Formulas

A link to the YouTube video lecture can be found HERE (and the PDF of the lecture HERE).

Scroll down in this document to find the Worksheet Guide for this section.

Video #2: Nomenclature Worsheet Guide

Directions: Watch the YouTube video HERE and answer the following questions:

1. Another name for a **cation** is _____. (circle one) *metal* or *nonmetal*

2. Another name for an **anion** is _____. (circle one) *metal* or *nonmetal*

3. The word **binary** means ____. (cirlce one) *two elements* or *more than two elements*

4. A binary compound between a **cation** and an **anion** is _____. (circle one)

   ionic binary compound or *covalent binary compound*

5. A binary compound between **two anions** is _____. (circle one)

   ionic binary compound or *covalent binary compound*

6. Which of the following is a **cation**? (circle one) *calcium (Ca)* or *fluorine (F)*

7. Which of the following is an **anion**? (circle one) *sodium (Na)* or *sulfur (S)*

8. What are the names of the following compounds:

Compound	**Name**
a. $NaCl$	_____
b. KI	_____
c. $MgCl_2$	_____
d. Ca_3N_2	_____

9. What are the names of the following compounds:

Compound	**Name**
a. $NaNO_3$	_____
b. K_2SO_4	_____
c. $Mg_3(PO_4)_2$	_____
d. Li_2CO_3	_____

Polyatomics and Rules to Memorize:

- **Acetate $C_2H_3O_2^-$**
- **Bicarbonate HCO_3^-**
- **Bisulfate HSO_4^-**
- **Bromate BrO_3^-**
- **Carbonate CO_3^{2-}**
- **Chlorate ClO_3^-**
- **Chromate CrO_4^{2-}**
- **Dichromate $Cr_2O_7^{2-}$**
- **Iodate IO_3^-**
- **Nitrate NO_3^-**
- **Phosphate PO_4^{3-}**
- **Sulfate SO_4^{2-}**
- **"bi" means add one H**
- **"per-" means add one oxygen**
- **"-ite" means subtract one oxygen**
- **"hypo-ite" means subtract two oxygens**

10. What are the names of the following compounds:

Compound	**Name**
a. K_2SO_4	_____
b. $CsNO_2$	_____
c. $Sr(ClO)_2$	_____
d. $Al(HCO_3)_3$	_____

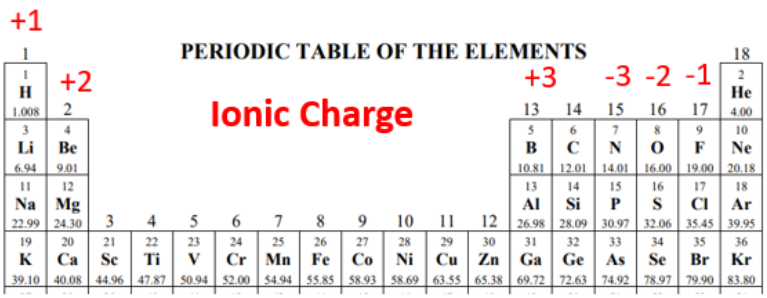
11. When an element has **multiple cations,** you can tell the cation's charge by looking at _____. (circle one)

the Roman Numerals or *a textbook*

12. Write the cations and anion charge for the following compounds (see example below):

Compound Formula	**Cation Charge**
nickel(II) sulfate	_____ Ni^{2+} _____
iron(II) chloride	_____
copper(I) bichromate	_____

13. Nearly all elements want _____ valence electrons. (circle one) *six* or *eight*



14. All compounds prefer a **net charge** of _____. (circle one). *zero* or *eight*

15. What are the formulas of the following compounds:

Compound	Formula
a. magnesium sulfate	_____
b. nickel(III) percarbonate	_____
c. sodium nitride	_____
d. sodium nitrite	_____

16. What are the names of the following compounds:

Compound	Name
a. P_4F_3	_____
b. N_2O	_____
c. NO_5	_____

Subscript	Prefix
1	mono
2	di
3	tri
4	tetra
5	penta
6	hexa
7	hepta
8	octa
9	nona
10	deca

17. What are the formulas of the following compounds:

Compound	Formula
a. hexasulfur diiodide	_____
b. silicon trioxide	_____
c. carbon monobromide	_____

Practice:

18. What are the names of the following compounds:

Compound	Name
a. SiO_2	_____
b. Na_2S	_____
c. Ca_3N_2	_____
d. PCl_5	_____
e. $Ni_3(PO_3)_2$	_____
f. Cl_2O_7	_____
g. $Cu_2(Cr_2O_7)$	_____
h. $Mg(NO_3)_2$	_____
i. $CoCO_3$	_____

19. What are the formulas of the following compounds:

Compound	Formula
a. Iron (II) oxide	_____
b. calcium nitride	_____
c. phosphorous pentachloride	_____

d. sulfur dioxide _____

e. aluminum phosphate _____

f. dihydrogen monoxide _____

g. potassium bicarbonate _____

Video #3: Solubility & Balancing & Net Ionic Formulas Worsheet Guide

Directions: Watch the YouTube video HERE and answer the following questions:

Solubility Rules to Memorize:

The following are always soluble in water:

- Group 1 ions: Li^+ Na^+ K^+ Rb^+ Cs^+
- Ammonia NH_4^+
- Acetate $C_2H_3O_2^-$
- Nitrate NO_3^-

- **For the purposes of the AP Exam, all other substances are *insoluble* unless noted in the question.**

1. Determine if the following are soluble or insoluble (circle one)

a. NaI *soluble* or *insoluble*

b. K_2CO_3 *soluble* or *insoluble*

c. $Al(OH)_3$ *soluble* or *insoluble*

d. $PbSO_4$ *soluble* or *insoluble*

e. $AgCl$ *soluble* or *insoluble*

f. $(NH_4)_2S$ *soluble* or *insoluble*

g. $AlPO_4$ *soluble* or *insoluble*

h. Na_2SO_3 *soluble* or *insoluble*

i. MgC_2O_4 *soluble* or *insoluble*

j. BaF_2 *soluble* or *insoluble*

k. $Mg(ClO_3)_2$ *soluble* or *insoluble*

l. Cs_2CO_3 *soluble* or *insoluble*

m. $RbC_2H_3O_2$ *soluble* or *insoluble*

n. $Sr(NO_3)_2$ *soluble* or *insoluble*

$$H_2 + O_2 \rightarrow H_2O$$

2. For the above reaction, **H_2** is a ____. (circle one) *reactant* or *reactant*

3. For the above reaction, **H_2O** is a ____. (circle one) *reactant* or *reactant*

4. Conservation of mass means ____. (circle one)

we have to find if an compound is soluble

or

we have to balance the equation

5. We balance equations by ____. (circle one)

adding subscripts only or *adding coefficients only*

6. Balance the following equations:

___ N_2 + ____H_2 → ____ NH_3

___Li + ____O_2 → ___Li_2O

___$Pb(NO_3)_2$ + ___K_2CrO_4 → ___$PbCrO_4$ + ___KNO_3

___C_4H_8 + ___O_2 → ___CO_2 + ___H_2O

7. The equations that use the complete compounds are _____. (circle one)

   molecular equations or *complete ionic equations* or *net ionic equations*

8. The equations that use the complete set of ions are _____. (circle one)

   molecular equations or *complete ionic equations* or *net ionic equations*

9. The equations that use only the ions that yield the solid are _____. (circle one)

   molecular equations or *complete ionic equations* or *net ionic equations*

10. The symbol **(*aq*)** means _____. (circle one) *aqueous* or *solid* or *gas*

11. The symbol **(*s*)** means _____. (circle one) *aqueous* or *solid* or *gas*

12. The symbol **(*g*)** means _____. (circle one) *aqueous* or *solid* or *gas*

13. The symbol **(*l*)** means _____. (circle one) *aqueous* or *solid* or *liquid*

14. Which of the following symbols would expect after an **insoluble** compound? (cirlce one)

   (*g*) or (*s*) or (*aq*)

15. Which of the following symbols would expect after a **soluble** compound dissolved in water? (cirlce one)

   (*g*) or (*s*) or (*aq*)

16. For the following reaction, write the balanced:

$$BaCl_{2(aq)} + 2AgNO_{3(aq)} \rightarrow Ba(NO_3)_{2(aq)} + 2AgCl_{(s)}$$

a. Molecular equation:

b. Complete ionion equation:

c. Net ionion equation:

17. For the following reaction, write the balanced:

$$CaCl_{2(aq)} + 2NaOH_{(aq)} \rightarrow Ca(OH)_{2(s)} + 2NaCl_{(aq)}$$

a. Molecular equation:

b. Complete ionion equation:

c. Net ionion equation:

18. For the following reaction, write the balanced:

$$LiNO_{3(aq)} + NaOH_{(aq)} \rightarrow$$

a. Molecular equation:

b. Complete ionion equation:

c. Net ionion equation:

19. For the following reaction, write the balanced:

$$Al(NO_3)_3 + NaOH \rightarrow$$

a. Molecular equation:

b. Complete ionion equation:

c. Net ionion equation:

20. For the following reaction, write the balanced:

$$K_3PO_4 + Ca(NO_3)_2 \rightarrow$$

a. Molecular equation:

b. Complete ionion equation:

c. Net ionion equation:

Video #4: Molar Conversions Worsheet Guide

Directions: Watch the YouTube video HERE and answer the following questions:

1. **The mole** is ____. (circle one) *9.109 x 10^{-31} things* or *6.022 x 10^{23} things*

2. **Molar mass** is ____. (circle one)

   the mass of 1 mole of something or *one (1) gram*

3. **Molar mass** can also be thought of as ____. (circle one)

   the mass of 6.022 x 10^{23} things or *one (1) gram*

4. How many grams are in 3.0 moles of H_2O?

5. How many moles are in 4.2g of $NaNO_3$?

6. What are the **only non-significant digits**? (circle one)

   zeros to the left or *two's*

Molar Conversions

1 mol = 6.022 x 10^{23}

1 mol = Molar Mass

1 mol = 22.4 L (at STP)

STP: Standard Temperature and Pressure

Pressure = 1 am
Temperature = 273 K

7. Calculate the mass of 2.5L of oxygen gas at STP.

8. Calculate the number of atoms of P in 120.0 g of P_2O_5

9. Calculate the number of atoms of P in 120.0 g of P_2O_5

10. How many grams are in 2.5 moles of $CaCO_3$?

11. How many liters are in 3.20 g of NaCl at STP?

12. How many atoms of oxygen (O) are in 2.1 g of $LiNO_3$?

13. How many liters are in 4.500×10^{25} atoms of pure helium (He) at STP?

Video #5: Stoichiometry Worsheet Guide

Directions: Watch the YouTube video HERE and answer the following questions:

Stoichiometry Rules

1. 6.022×10^{23} **atoms/molecules:**
2. **Molar Mass (*MM*) g** (Periodic Table)
3. **22.4 L** (at STP)
4. **coefficient A** ***mol* A** (Balanced Equation)
   coefficient B ***mol* B**

Note: Only change substances in mole ratio

1. How many grams of H_2O would be produce if the below reactions starts with 2.0 g of O_2?

$$2H_2 + O_2 \rightarrow 2H_2O$$

2. How many moles of H_2 would be needed to create 3.4×10^{23} molecules of NH_3 at STP?

$$3H_2 + N_2 \rightarrow 2NH_3$$

3. How many liters of NH_3 would be created from 0.50 grams of N_2 at STP?

$$3H_2 + N_2 \rightarrow 2NH_3$$

4. If given 2.0 moles of $AgNO_3$, how many moles of $NaNO_3$ can be produced?

$$\boldsymbol{3AgNO_3 + Na_3PO_4 \rightarrow Ag_3PO_4 + 3NaNO_3}$$

5. If given 3.0 grams of $AgNO_3$ (*MM* = 169.87 g/mol) how many grams of Ag_3PO_4 (*MM* = 418.58 g/mol) can be produced? $\boldsymbol{3AgNO_3 + Na_3PO_4 \rightarrow Ag_3PO_4 + 3NaNO_3}$

6. If 0.450 mol CH_4 (*MM* = 16.04 g/mol) is combusted at STP according the reaction below, how many liters of O_2 will be used in the reaction? $\boldsymbol{CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O}$

7. How many moles of carbon dioxide would be created if the reaction started with 0.300L of oxygen gas, O_2 at STP? $\boldsymbol{CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O}$

8. According to the last two problems, what produced less carbon dioxide (CO_2)? (circle one)

0.300g C_3H_8 or *0.300L* O_2?

9. If the **limiting reactant** is the reactant that **produces the less amount of product,** what was the limiting reactant of the reaction? (circle one)

0.300g C_3H_8 or *0.300L* O_2?

Video #6: Limiting Reactants Worsheet Guide

Directions: Watch the YouTube video HERE and answer the following questions:

1. Limiting reactants are reactants that ____. (circle one) *run out first* or *run out last*

2. Limiting reactants are reactants that produce the ____. (circle one)

   fewest products or *most products*

Finding Limiting Reactants: Convert both reactants to ***the same product*** and ***choose the smaller number***

3. The following reaction starts with 6.0 g of Ca and 3.0 mol of V_2O_5.

   $5Ca + V_2O_5 \rightarrow 5CaO + 2V$

   a. What is the limiting reactant (LR)?

   b. How many grams of CaO can be theoretically produced?

   c. If you run the experiment and actually produce 3.6 g of the product, what is the percent yield?

Percent yield: The percentage of how much product is actually produced

$$\frac{actual}{theoretica\,l} x100 = \%\,yield$$

- ***Actual yield*** is given in the problem (or found in lab)
- ***Theoretical yield*** is found in stoichiometry

4. For the following reaction you are given 2.0 g of Zn and 0.040 mol of HCl.

Zn + 2 HCl → H_2 + $ZnCl_2$

a. What is the limiting reactant (LR)?

b. How many liters of H_2 can be theoretically produced at STP?

c. If you run the experiment and actually produce 0.29 L of the H_2, what is the percent yield?

Amount of Excess Left Over: Multi-step problem

1. Find limiting reactant
2. Convert limiting reactant to excess reactant
3. Subtract that answer from given excess reactant

5. For the following reaction you are given 3.0 mol of N_2 and 2.0 L of H_2. If the reaction is run at STP, how much excess reactant is left over? **N_2 + 3 H_2 → 2 NH_3**

6. Given the following reaction and that 60.0 g of C and 21.0 g of H_2 are used:

$C_{(s)}$ + 2H_2 → CH_4

   a. What is the percent yield of the reaction is 75.1 g of CH_4 are actually produced?

b. How much excess reactant is left over?

c. How many molecules of CH_4 are theoretically created in the experiment?

7. The following reaction takes place at STP and includes 0.55L of oxygen gas, O_2, and 1.2g of propane, C_3H_8.

$$\boldsymbol{C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O}$$

   a. What is the percent yield of the reaction is 75.1L of carbon dioxide, CO_2, is actually produced?

b. How much excess reactant is left over?

c. How many moles of water, H_2O, would theoretically be produced in the reaction?

Video #7: Empirical Formulas Worsheet Guide

Directions: Watch the YouTube video HERE and answer the following questions:

1. **Empirical formulas** are the ___. (circle one)

   most reduced chemical formulas of compounds

   or

   least reduced chemical formulas of compounds

2. **Molecular formulas** are the ___. (circle one)

   empirical formulas divided by a whole number factor

   or

   empirical formulas multiplied by a whole number factor

Empirical Formulas: The most reduced chemical formulas of compounds

Molecular Formulas: Empirical formulas multiplied by a whole number factor

3. Write the whole number factor that makes the following molecular formulas:

Empirical Formulas	Factor	Molecular Formulas
1. CH_2	x_____	1. C_4H_8
2. $C_6H_{12}O_6$	x_____	2. $C_6H_{12}O_6$
3. NO_2	x_____	3. N_3O_6
4. NaOH	x_____	4. $Na_2(OH)_2$

Molecular Ratios: The molecular formula tells ratio of moles present in the molecules themselves

4. If you have 0.300 mol of H_2O, how many moles of H do you have?

5. If you have 0.300 mol of CO_2, how many moles of C do you have?

Percent Composition: Percentage of mass in compound

$$\%\ composition = \frac{mass\ part}{whole\ mass}\ x\ 100$$

6. Find the percent by mass of Ca in $Ca(OH)_2$

7. A sample of a substance containing only magnesium and chlorine was tested in the laboratory and found to be composed of 74.5% chlorine by mass. If the total mass of the sample was 190.2 grams, what is the mass of the chlorine?

8. How many grams of carbon are there in 5.60 g of C_2H_6O?

9. If you have **0.300 mol of H_2O**, how many **mol of *H*** do you have?

10. What is the percent composition of ***Na*** in ***NaCl***?

11. What is the mass percent of hydrogen (***H***) in **2.5 g CH_4**?

Finding Empirical Formulas:

1. Assume all percentages are grams
2. Convert each **grams to moles** (divide by molar mass)
3. Divide each mole answer by the **smallest** mole answer
4. Make each ratio a whole number
5. Place each whole number with its element in the empirical formula

12. What is the empirical formula for a substance that is made up of 88.7% carbon and 11.3% hydrogen?

Molecular formulas = (Empirical formula)$_n$

- Find empirical formula like before
- Find molar mass of empirical formula
- Divide **given mass** by **molar mass of empirical formula**
- Multiply that number by all subscripts in empirical formula

13. What is the molecular formula for a substance that has a mass around 28g and is composed of 78.14% B and 21.86% H?

14. If the final molar mass of the product is about 174g, what is the molecular formula when you combine 63.00% Mn and 37.00% O?

Video #8: Combustion Empirical Formulas Worsheet Guide

Directions: Watch the YouTube video HERE and answer the following questions:

Combustion Empirical Formulas

$$\boxed{C_xH_x} + O_2 \rightarrow CO_2 + H_2O$$

1. Use CO_2 to find mols of C

   ____g / 44.01 x 1 = ____ mol C

2. Use H_2O to find mols of H

   ____g / 18.02 x 2 = ____ mol H

4. A hydrocarbon fuel (containing only C's and H's) is fully combusted with 22.000g of oxygen to yield 23.118g of carbon dioxide and 9.458g of water. Find the empirical formula for the hydrocarbon.

Combustion Empirical Formulas

$$\boxed{C_xH_xO_x} + O_2 \rightarrow CO_2 + H_2O$$

1. Use CO_2 to find mols of C

   ____g / 44.01 x 1 = ____ mol C

2. Use H_2O to find mols of H

   ____g / 18.02 x 2 = ____ mol H

3. Find total mass of C and H

   (___mol C x 12.01) + (___mol H x 1.01)

4. Subtract from total mass to find mass of O

5. Find mol of O

   ___ mol O / 16.00

6. Divided by smallest mole and find empirical formula

5. A 15.0 g sample of an organic solvent (C's, H's, and O's) is analyzed by combustion analysis and produces 34.10 g of carbon dioxide and 7.00 g of water. What is the empirical formula?

6. Isopropyl alcohol is composed of C, H, and O. If combustion 0.255g of alcohol produces 0.561 g of CO_2 and 0.306 g of H_2O. Determine the empirical formula of isopropyl alcohol.