2018-2019 AP Chemistry Summer Assignment

Complete all work (Yes, you have to show your work!!) on a separate piece of paper, then attach to these pages. Only write your answers on these pages. I have provided some resources to help you with the topics below but your notes from Honors will be a big help, too. Don't be afraid to search for further resources so you can get a good grasp on the concepts! You are expected to be comfortable with these concepts upon arriving back to school. Tackle this little by little – DO NOT wait until the last minute to complete this assignment!!

Significant Figures (https://goo.gl/2nQw6h)

1. What is the number of significant figures in each of the following measured quantities?

   (A) 358 kg _____
   (B) 0.054 s _____
   (C) 6.3050 cm _____
   (D) 0.0105 L _____
   (E) 7.0500×10^{-3} m^3 _____

2. Indicate the number of significant figures in each of the following measured quantities:

   (A) 3.774 km _____
   (B) 205 m^2 _____
   (C) 1.700 cm _____
   (D) 5.6840×10^{2} mL _____
   (E) 4×10^{-10} kg _____
   (F) 23000 mg _____
   (G) 0.00023040 mol _____
   (H) 7.2500 g _____
   (I) 400 lb _____
   (J) 4.2×10^{-5} mol _____

3. Round each of the following numbers to four significant figures and express the result in scientific notation:

   (A) 102.53070 _____
   (B) 656,980 _____
   (C) 0.008543210 _____
   (D) 0.000257870 _____
   (E) -0.0357202 _____

4. Round each of the following to three significant figures:

   (A) 234555359 _____
   (B) 0.090035 _____
   (C) 939.25 _____
   (D) 14090 _____
   (E) 0.008499 _____
   (F) 11.1111 _____

5. Carry out the following operations and express the answers with the appropriate number of significant figures.

   (A) 12.0550 + 9.05 _____
   (B) 257.2 – 19.789 _____
   (C) $(6.21 \times 10^{3})(0.1050)$ _____
   (D) 0.0577/0.753 _____
   (E) 12.5849 + 2.4 _____
   (F) 432.5 – 24.3984 _____
   (G) (246)(1.5) _____
   (H) 974.59/14.2 _____

Nomenclature (https://goo.gl/1RbO1f)

1. Locate each of the following elements in the periodic table; indicate whether it is a metal, nonmetal, or metalloid (check one) and give the name of the element.

Symbol	Name	Metal?	Nonmetal?	Metalloid?
Ca				
Ti				
Ga				
Th				
Pt				
Se				
Kr				

2. Complete the attached Nomenclature Tables by naming the compound from the chemical formula or writing the formula from the compound name. If the compound is ionic, put a check under the "Ionic?" column.

Balancing, Stoichiometry, & Empirical Formula

1. Balance the following equations:

(A) ____ $Li(s)$ + ____ $N_2(g)$ → ____ $Li_3N(s)$

(B) ____ $La_2O_3(s)$ + ____ $H_2O(l)$ → ____ $La(OH)_3(aq)$

(C) ____ $NH_4NO_3(s)$ → ____ $N_2(g)$ + ____ $O_2(g)$ + ____ $H_2O(g)$

(D) ____ $Ca_3P_2(s)$ + ____ $H_2O(l)$ → ____ $Ca(OH)_2(aq)$ + ____ $PH_3(g)$

(E) ____ $Ca(OH)_2(aq)$ + ____ $H_3PO_4(aq)$ → ____ $Ca_3(PO_4)_2(s)$ + ____ $H_2O(l)$

(F) ____ $AgNO_3(aq)$ + ____ $Na_2SO_4(aq)$ → ____ $Ag_2SO_4(s)$ + ____ $NaNO_3(aq)$

(G) ____ $CH_3NH_2(g)$ + ____ $O_2(g)$ → ____ $CO_2(g)$ + ____ $H_2O(g)$ + ____ $N_2(g)$

(https://goo.gl/3tjh7q)

2. Calculate the following quantities:
   (A) mass, in grams, of 0.105 moles sucrose ($C_{12}H_{22}O_{11}$) _____
   (B) moles of $Zn(NO_3)_2$ in 143.50 g of this substance _____
   (C) number of molecules in 1.0×10^{-6} mol CH_3CH_2OH _____
   (D) number of N atoms in 0.410 mol NH_3 _____

3. (A) What is the mass, in grams, of 0.0714 mol of iron(III) sulfate? _____
   (B) How many moles of ammonium ions are in 8.776 g of ammonium carbonate? _____
   (C) What is the mass, in grams, of 6.52×10^{21} molecules of aspirin, $C_9H_8O_4$ _____
   (D) What is the molar mass of diazepam (Valium) if 0.05570 mol weighs 15.86 g? _____

(https://goo.gl/n1bvRm)

4. Determine the empirical formula of each of the following compounds if a sample contains

   (A) 0.104 mol K, 0.052 mol C, and 0.156 mol O _____

   (B) 5.28 g Sn and 3.37 g F _____

   (C) 87.5% N and 12.5% H by mass _____

5. What is the molecular formula of each of the following compounds?

   (A) empirical formula HCO_2, molar mass = 90.0 g/mol _____

   (B) empirical formula C_2H_4O, molar mass = 88 g/mol _____

6. Determine the empirical and molecular formulas of each of the following substances:
   (A) Ibuprofen, a headache remedy, contains 75.69% C, 8.80% H, and 15.51% O by mass, and has a molar mass of 206 g/mol.

   Empirical: _____ Molecular: _____

   (B) Cadaverine, a foul smelling substance produced by the action of bacteria on meat, contains 58.55% C, 13.81% H, and 27.40% N by mass; its molar mass is 102.2 g/mol.

   Empirical: _____ Molecular: _____

   (C) Epinephrine (adrenaline), a hormone secreted into the bloodstream in times of danger or stress, contains 59.0% C, 7.1% H, 26.2% O, and 7.7% N by mass; its molar mass is about 180 g/mol.

   Empirical: _____ Molecular: _____

7. The fermentation of glucose ($C_6H_{12}O_6$) produces ethyl alcohol (C_2H_5OH) and CO_2:

   $C_6H_{12}O_6(aq) \rightarrow 2C_2H_5OH(aq) + 2CO_2(g)$

   (A) How many moles of CO_2 are produced when 0.400 mol of $C_6H_{12}O_6$ reacts in this fashion?

   _____

   (B) How many grams of $C_6H_{12}O_6$ are needed to form 7.50 g of C_2H_5OH? _____

   (C) How many grams of CO_2 form when 7.50 g of C_2H_5OH are produced? _____

8. An iron ore sample contains Fe_2O_3 together with other substances. Reaction of the ore with CO produces iron metal:

   ____ $Fe_2O_3(s)$ + ____ $CO(g) \rightarrow$ ____ $Fe(s)$ + ____ $CO_2(g)$

   (A) Balance this equation.

   (B) Calculate the number of grams of CO that can react with 0.150 kg of Fe_2O_3. _____

   (C) Calculate the number of grams of Fe and the number of grams of CO_2 formed when 0.150 kg of Fe_2O_3 reacts. _____

Molarity

1. (A) Calculate the molarity of a solution made by dissolving 0.750 grams of Na_2SO_4 in enough water to form exactly 850 mL of solution. _____

   (B) How many moles of $KMnO_4$ are present in 250 mL of a 0.0475 M solution? _____

   (C) How many milliliters of 11.6 M HCl solution are needed to obtain 0.250 mol of HCl? _____

2. Calculate (A) the number of grams of solute in 0.250 L of 0.175 M KBr _____

   (B) the molar concentration of a solution containing 14.75 g of $Ca(NO_3)_2$ in 1.375 L _____

   (C) the volume of 1.50 M Na_3PO_4 in milliliters that contains 2.50 g of solute. _____

3. (A) How many grams of solute are present in 50.0 mL of 0.488 M $K_2Cr_2O_7$? _____

   (B) If 4.00 g of $(NH_4)_2SO_4$ is dissolved in enough water to form 400 mL of solution, what is the molarity of the solution? _____

   (C) How many milliliters of 0.0250 M $CuSO_4$ contain 1.75 g of solute? _____

4. (A) How many milliliters of a stock solution of 10.0 M HNO_3 would you have to use to prepare 0.450 L of 0.500 M HNO_3? _____

   (B) If you dilute 25.0 mL of the stock solution to a final volume of 0.500 L, what will be the concentration of the diluted solution? _____

5. (A) Starting with solid sucrose, $C_{12}H_{22}O_{11}$, describe how you would prepare 250 mL of a 0.250 M sucrose solution. _____

   (B) Describe how you would prepare 350.0 mL of 0.100 M $C_{12}H_{22}O_{11}$ starting with 3.00 L of 1.50 M $C_{12}H_{22}O_{11}$. _____

Bonding (https://goo.gl/BozuVv)

1. (A) What are valence electrons?

   (B) How many valence electrons does a nitrogen atom possess? _____

   (C) An atom has the electron configuration $1s^2 2s^2 2p^6 3s^2 3p^2$. How many valence electrons does the atom have?

   _____

2. (A) What is the octet rule?

(B) How many electrons must a sulfur atom gain to achieve an octet in its valence shell? _____
(C) If an atom has the electron configuration $1s^2 2s^2 2p^3$, how many electrons must it gain to achieve an octet?

_____

3. Write the electron configuration for the element titanium, Ti. How many valence electrons does this atom possess?

_____ # v. e. _____

4. Write the electron configurations for the following ions, and determine which have noble-gas configurations:

		Noble gas config.?	
(A) Zn^{2+}	_____	**yes**	**no**
(B) Te^{2-}	_____	**yes**	**no**
(C) Sc^{3+}	_____	**yes**	**no**
(D) Rh^{3+}	_____	**yes**	**no**

5. (A) Construct a Lewis structure for hydrogen peroxide, H_2O_2, in which each atom achieves an octet of electrons.

(C) Do you expect the O-O bond in H_2O_2 to be longer or shorter than the O-O bong in O_2?

_____

6. By referring only to the periodic table, select
(A) the most electronegative element in group 6A _____
(B) the least electronegative element in the group Al, Si, P _____
(C) the most electronegative element in the group Ga, P, Cl, Na _____

7. Which of the following bonds are polar? Which is the more electronegative atom in each polar bond?

Molecule:	**Polar? (Y or N)**	**More electronegative atom:**
B-F		
Cl-Cl		
Se-O		
H-I		

Limiting Reagent (https://goo.gl/XZzYcD)

1. $Mg(OH)_2 + 2HCl \rightarrow MgCl_2 + 2H_2O$
Given the equation above:
(A) How many grams of $MgCl_2$ will be produced from 12.0 grams of $Mg(OH)_2$ and 42.0 grams of HCl?

_____

(B) How many grams of the excess reactant remain after the limiting reactant has been consumed?

_____

(C) How many grams of H_2O will be produced from 45 grams of HCl and 19 grams of $Mg(OH)_2$?

_____

(D) What mass of the reactant in excess remains once the reaction is complete?

_____

2. $2Al + 3Cl_2 \rightarrow 2AlCl_3$
   Given the equation above:
   (A) What is the limiting reagent if we start with 2.80 grams of Al and 4.25 grams of Cl_2?

   _____

   (C) What is the theoretical yield of $AlCl_3$ that the reaction can produce when we start with the amounts in part A?

   _____

3. $BaCl_2 + 2AgNO_3 \rightarrow 2AgCl + Ba(NO_3)_2$
   The above reaction is performed with 1.56 grams of $BaCl_2$ which is the limiting reagent. We isolate 1.82 grams of our desired product, AgCl. What is the percent yield of the reaction?

   _____

Periodic Trends (https://goo.gl/YBToK9)

1. Rank the following elements by increasing atomic radius: C, Al, O, K

   _____ < _____ < _____ < _____

2. Rank the following elements by increasing electronegativity: S, O, Ne, Al

   _____ < _____ < _____ < _____

3. Indicate whether the following properties increase or decrease from left to right across the periodic table:

a.	Atomic radius	**increase**	**decrease**
b.	Ionization energy	**increase**	**decrease**
c.	Electronegativity	**increase**	**decrease**

4. Circle the atom in each pair that has the greater ionization energy:

Li or Be Ca or Ba Na or K P or Ar Cl or Si Li or K

5. Circle the atom in each pair that has the greater electronegativity:

Ca or Ga Br or As Li or O Ba or Sr Cl or S O or S

Nomenclature Tables

Compound Name	Chemical Formula	Ionic?
Ammonium chloride		
Aluminum oxide		
Potassium bromide		
Tin(II) iodide		
Tin(IV) dichromate		
Copper(II) sulfate		
Silver sulfide		
Cesium iodide		
Magnesium hydrogen carbonate		
Titanium(IV) oxide		
Nitrogen dioxide		
Sulfur trioxide		
Potassium hypochlorate		
Hydrogen sulfide		
Copper(I) oxide		
Barium hydroxide		
Radium nitrate		
Ammonium chromate		
Carbon tetrachloride		
Lithium cyanide		
Iron(III) acetate		
Barium permanganate		
Dibromine trioxide		
Dichlorine monoxide		
Iodine heptafluoride		

Chemical Formula	Compound Name	Ionic?
NH_4Cl		
Al_2O_3		
KBr		
K_2S		
SnI_2		
Cu_2O		
Ag_2S		
CsI		
$Ni(NO_3)_2$		
Cl_2O		
$AlPO_4$		
$MnSO_3$		
$(NH_4)_2HPO_4$		
$ZnCr_2O_7$		
$Ca(ClO_3)_2$		
NO_2		
ScI_3		
Hg_2Cl_2		
P_2O_5		
$(NH_4)HSO_4$		
IF_7		
Br_2O_3		
$Ba(OH)_2$		
$Mg(NO_2)_2$		
$Al(C_2H_3O_2)_3$		