http://www.jpsaos.com/pittenger/summerreview.htm

AP Chemistry Summer Assignment Part I

Due Date: ***July 1st***

Summer Assignment Part I will count as the first hw assignment for the 1st marking period. You must submit it via the google form , **https://forms.gle/sgqiNUR6AzXZhh1NA** The following questions will be found on the google form.

1. Proceed to the following website http://www.jpsaos.com/tujague Navigate to the AP Chemistry page and Click on the *Summer Review* link and then on the first link to submit your email address. ***Have you submitted your email address as well as a parent's email address? (Yes or No answer is fine)***

2. **Have you joined the Google Classroom "Team AP Chem 2024-2025?" Class code** jekpxrn ***(Yes or No answer is fine)***

3. ***Have you printed up the safety contract, read it, and had you and your parents sign it? (Yes or No answer is fine)***

4. Download the file titled "Advice from AP Chem Alumni" and read it thoroughly. We believe that the words of fellow students will make more of an impression on you than if I said the same thing. Take the advice and tips on how to be successful in this class. ***What alumni advice struck you the most? What did you learn from reading what they suggested?***

5. ***Why are you taking AP Chemistry? (Be completely honest.)***

6. Proceed to the following website http://www.jpsaos.com/pittenger/APchemistry.htm Click the link for *Reference Materials*. On this page, click the link and download the file titled "Success in AP Chemistry" and read it thoroughly. ***What are you hoping to get out of this course? What habits and behaviors are you willing and able to commit to for a greater chance of success?***

7. ***What topic from Honors Chem do you feel is your strongest? What topic do you feel is your weakest?***

8. ***What are you looking forward to the most in this class? What, if anything, are you fearing the most about this class?***

9. The Summer Assignment Part II contains integral basic information that you MUST know BEFORE school starts in September. Topics range from memorization of ion charges and polyatomic ions, naming and writing formulas for ionic and covalent compounds and acids, and basic mathematical skills such as significant figures, dimensional analysis (unit conversion), and stoichiometry. ***Do you know all of the charges for the representative elements? (Yes or No answer is fine) Do you know the charges for many of the common polyatomic ions (sulfate, sulfite, nitrate, nitrite, etc.)? If No, then please tell us how you will study them this summer.***

10. The Summer Assignment Part III contains sample problems. These problems must be completed and handed in on the first day of School. ***Are you prepared to begin and finish the Summer Assignment Part II and Part III before Labor Day? (Yes or No answer is fine) If No, then please give a reason as to why you can't meet this deadline.***

AP Chemistry Summer Assignment Part II

Due Date: Important Concepts to Know for <u>First Day of School</u>

Please thoroughly read chapters 1,2, and 3 this summer (Zumdahl, Steven S., Zumdahl, Susan A. Chemistry. Houghton Mifflin Company; New York, 1997.) 8th Edition.

1. Charges of common elements and polyatomic ions

Variable Valences for Transition Metals

Element Name	Symbol	Charge	Stock Name	Classical Name
Chromium	Cr	+2 +3	Chromium (II) Chromium (III)	
Manganese	Mn	+2 +3	Manganese (II) Manganese (III)	
Iron	Fe	+2 +3	Iron (II) Iron (III)	Ferrous Ferric
Cobalt	Co	+2 +3	Cobalt (II) Cobalt (III)	
Copper	Cu	+1 +2	Copper (I) Copper (II)	Cuprous Cupric
Lead	Pb	+2 +4	Lead (II) Lead (IV)	Plumbous Plumbic
Mercury	Hg	+1 +2	Mercury (I) Mercury (II)	Mercurous Mercuric
Tin	Sn	+2 +4	Tin (II) Tin (IV)	Stannous Stannic
Gold	Au	+1 +3	Gold (I) Gold (III)	
Silver	Ag	+1 +2 (rarely)	Silver Silver (II)	
Bismuth	Bi	+3 +5	Bismuth (III) Bismuth (V)	
Antimony	Sb	+3 +5	Antimony (III) Antimony (V)	
Cadmium	Cd	+s	Cadmium	
Zinc	Zn	+2	Zinc	

IONS LIST

acetate	$C_2H_3O_2^-$	ferric	Fe^{3+} (yellow)	oxalate	$C_2O_4^{2-}$
aluminum	Al^{3+}	ferrous	Fe^{2+} (green)	oxide	O^{2-}
ammonium	NH_4^+	fluoride	F^-	perbromate	BrO_4^-
barium	Ba^{2+}	hydrogen	H^+	perchlorate	ClO_4^-
bicarbonate	HCO_3^-	hydronium	H_3O^+	periodate	IO_4^-
bisulfate	HSO_4^-	hydroxide	OH^-	permanganate	MnO_4^- *(purple)*
bisulfide	HS^-	hypobromite	BrO^-	peroxide	O_2^{2-}
bisulfite	HSO_3^-	hypochlorite	ClO^-	phosphate	PO_4^{3-}
bromate	BrO_3^-	hypoiodite	IO^-	phosphide	P^{3-}
bromide	Br^-	iodate	IO_3^-	phosphite	PO_3^{3-}
bromite	BrO_2^-	iodide	I^-	potassium	K^+
calcium	Ca^{2+}	iodite	IO_2^-	silver	Ag^+
carbonate	CO_3^{2-}	lead	Pb^{2+}	sodium	Na^+
chlorate	ClO_3^-	lithium	Li^+	stannic	Sn^{4+}
chloride	Cl^-	magnesium	Mg^{2+}	stannous	Sn^{2+}
chlorite	ClO_2^-	manganese	Mn^{2+}	strontium	Sr^{2+}
chromate	CrO_4^{2-} (yellow)	mercuric	Hg^{2+}	sulfate	SO_4^{2-}
chromium	Cr^{3+}	mercurous	Hg_2^{2+}	sulfide	S^{2-}
cupric	Cu^{2+} (blue)	nickel	Ni^{2+} (green)	sulfite	SO_3^{2-}
cuprous	Cu^+ (green)	nitrate	NO_3^-	thiocyanate	SCN^-
cyanide	CN^-	nitride	N^{3-}	thiosulfate	$S_2O_3^{2-}$
dichromate	$Cr_2O_7^{2-}$ (orange)	nitrite	NO_2^-	zinc	Zn^{2+}

2. Rules for Naming Acids http://www.jpsaos.com/pittenger/naming_flowchart.pdf

a. When the name of the anion ends in –ide, the acid name begins with the prefix hydro-, the stem of the anion has the suffix –ic and it is followed by the word "acid".
For example: HCl: Cl- is chloride, so HCl = hydrochloric acid

b. When the anion name ends in –ite, the acid name is the stem of the anion with the suffix –ous, followed by the word "acid".
For example: ClO_2^- is the chlorite ion, so $HClO_2$ = chlorous acid

c. When the anion name ends in –ate, te acid name is the stem of the anion with the suffix –ic, followed by the word "acid"
For example: ClO_3^- is the chlorate ion, so $HClO_3$ = chloric acid

d. When the anion name begins with per-, the acid name begins with per- and the stem of the anion has the suffix –ic and it is followed by the word "acid"
For example: ClO_4^- is the perchlorate ion, so $HClO_4$ = perchloric acid

3. Rules for Naming Ionic Compounds http://www.jpsaos.com/pittenger/naming_flowchart.pdf

a. Balance charges – overall charges for compound should always = 0
b. Cation is always written first (in name and in formula)
c. Change the ending of the anion (if an element) to –ide. If a polyatomic ion, the ion name does not change.

4. Solubility Rules http://www.jpsaos.com/pittenger/appowerpoint/precipitationdiagram.pdf

a. All compounds containing alkali metal cations or the ammonium ion are soluble.
b. All compounds containing NO_3^-, ClO_4^-, ClO_3^-, and $C_2H_3O_2^-$ anions are soluble.
c. All chlorides, bromides, and iodides are soluble except those containing Ag^+, Pb^{2+}, or Hg^{2+}.
d. All sulfates are soluble except those containing Hg^{2+}, Pb^{2+}, Sr^{2+}, Ca^{2+}, or Ba^{2+}.
e. All hydroxides are insoluble, except compounds of the alkali metals, ammonium, Ca^{2+}, Sr^{2+}, or Ba^{2+}.
f. All compounds containing PO_4^{3-}, S^{2-}, CO_3^{2-}, and SO_3^{2-} are insoluble, except compounds of the alkali metals or ammonium.

5. Rules for Determining Oxidation Number

Oxidation Number: a number assigned to an atom in a molecular compound or molecular ion that indicates the general distribution of electrons among the bonded atoms.

a. The oxidation number of any uncombined element is zero (0).
b. The oxidation number of a monatomic ion is equal to the charge on the ion.
c. The more electronegative element in a binary compound is assigned the number equal to the charge it would have if it were an ion.
d. The oxidation number of fluorine in a compound is always -1.
e. Oxygen has an oxidation number of -2 unless it is combined with fluorine (where it will be +2) or it is in a peroxide (where it will be -1).
f. The oxidation state of hydrogen in most of its compounds is +1 unless it is combined with a metal, in which case it will be -1.
g. In compounds, the elements of Groups 1 and 2, as well as aluminum have oxidation numbers of +1, +2, and +3, respectively.
h. The sum of the oxidation numbers of all atoms in a neutral compound is 0.
i. The sum of the oxidation numbers of all atoms in a polyatomic ion is equal to the charge of the ion.

6. Strong Acids and Strong Bases

Strong Acid		Strong Base	
HCl	hydrochloric acid	LiOH	lithium hydroxide
HBr	hydrobromic acid	NaOH	sodium hydroxide
HI	hydroiodic acid	KOH	potassium hydroxide
$HClO_4$	perchloric acid	RbOH	rubidium hydroxide
$HClO_3$	chloric acid	CsOH	cesium hydroxide
HIO_4	periodic acid	$Ca(OH)_2$*	calcium hydroxide
H_2SO_4	sulfuric acid	$Sr(OH)_2$*	strontium hydroxide
HNO_3	nitric acid	$Ba(OH)_2$*	barium hydroxide

* These bases completely dissociate in solutions of 0.01 M or less.
There are other strong bases than those listed, but they are not often encountered

7. Significant Figures

On the AP Chemistry exam, significant figures matter and we will not have time to review them through the year, however, you will be graded upon using sig. figs. all year long. It is something you must know.

a. Go to the following websites and review sig. figs.

http://www.chem.sc.edu/faculty/morgan/resources/sigfigs/index.html

http://science.widener.edu/svb/tutorial/sigfigures.html

b. When using molar mass in stoichiometry problems, never let the molar mass limit the number of sig. figs. in your final answer.

For example: How many moles of Carbon are there in 44.0 grams of Carbon?
There are 3 sig. figs. in 44.0, so the molar mass of carbon that you use in your calculation must have 3 or more sig. figs. MM of carbon is 12.01 g/mol and **not** 12 g/mol.

8. Exact and Inexact Numbers

Click on the following link (reference section of our website) to learn more about exact and inexact numbers.

http://www.jpsaos.com/pittenger/exactvsinexact.doc

Name _____ Date_____
Period _____

Summer Assignment Part III

Due Date: <u>First Day of School</u>

Complete the following Problem Sets and bring this in on the first day of school. Email us if you have any questions during the summer.

Problem Set 1- Math Basics

1. How many significant figures are in each of the following?
   a. 12
   b.10980
   c. 2001
   d. 2.001×10^{3}
   e. 0.0000101
   f. 1.01×10^{-5}
   g. 1000.
   h. pH 2.1

2. Use scientific notation to express the number 480 to
   a. one significant figure
   b. two significant figures
   c. three significant figures
   d. four significant figures

3. Perform the following mathematical operations and express each result to the correct number of significant figures.
   a. 97.381 ÷ 4.2502 + 0.99195=
   b. 171.5 + 72.915 – 8.23=
   c.1.00914 ÷ 0.87104 + 1.2012=
   d. 21.901 – 13.21 – 4.0215 =

4. Perform the following mathematical operations, and express each result to the correct number of significant figures.

   a. (0.102 x 0.0821 x 273) ÷ 1.01=
   b. $0.14 \times (6.022 \times 10^{23})$=
   c. $(4.0 \times 10^{4}) \times (5.021 \times 10^{-3}) \times (7.34993 \times 10^{2})$=
   d. $(2.00 \times 10^{6}) \div (3.00 \times 10^{-7})$=
   e. 4.184 x 100.62 x (25.27 – 24.16)=
   f. [(8.925 – 8.904) ÷ 8925] x 100=
   g. (9.04 + 8.23 + 21.954 + 81.0) ÷ 3.1416=
   h. (9.2 x 100.65) ÷ (8.321 + 4.026)=
   i. 0.6154 + 2.07 – 2.114 =
   j. 8.27(4.987 – 4.962)=
   k. (9.5 + 4.1 + 2.8 + 3.175) ÷ 4= (assume that this operation is taking the average of four numbers, therefore the 4 in the denominator is an exact number.)
   l. [(9.025 – 9.024) ÷ 9.025] x 100= (100 is exact)

5. The density of aluminum is 2.70 g/cm^{3}. Express this value in units of kilograms per cubic meter and pounds per cubic foot.

6. A material will float on the surface of a liquid if the material has a density less than that of the liquid. Given that the density of water is approximately 1.0 g/mL, will a block of material having a volume of 1.2×10^{4} in^{3} and weighing 350 lb float or sink when placed in a reservoir of water?

7. A star is estimated to have a mass of 2×10^{36} kg. Assuming it to be a sphere of average radius 7.0×10^{5} km, calculate the average density of the star in units of grams per cubic centimeter.

8. A rectangular block has dimensions 2.9 cm x 3.5 cm x 10.0 cm. The mass of the block is 615.0 g. What are the volume and density of the block?

9. Calculate the percentage error for the each case:
   a. The density of aluminum block determined in an experiment was 2.64 g/cm^3. The true value is 2.70 g/cm^3.

   b. The experimental determination of iron in a sample of iron ore was 16.48%. The true value was 16.12%.

Problem Set 2- Atoms, Ions, and Compounds

1. You have a chemical in a sealed glass container filled with air. The system has a mass of 250.0 g. The chemical is ignited by means of a magnifying glass focusing sunlight on the reactant. After the chemical is completely burned, what is the mass of the setup? Explain your answer.

2. Find the empirical and molecular formulas of the following compounds.
   a. 73.8% carbon, 8.7% hydrogen, 17.5% nitrogen, molar mass = 166.0g/mol

   b. 80.0% carbon, 20.0% hydrogen, molar mass = 30.0 g/mol

3. In the periodic table, how many elements are found in
   a. The second period?
   b. The third period?
   c. Group 2A?
   d. The oxygen family?
   e. The fourth period?
   f. The nickel group?
   g. Group 8A?

4. Give the number of protons and neutrons in the nucleus of each of the following atoms:

   a. $^{238}_{84}Pu$
   b. $^{65}_{29}Cu$
   c. $^{52}_{24}Cr$
   d. $^{60}_{27}Co$
   e. $^{52}_{24}Cr$
   f. $^{4}_{2}He$

5. Complete the following table:

Symbol	Number of protons in nucleus	Number of neutrons in the nucleus	Number of electrons	Net charge
	33	42		3+
$^{128}_{52}Te^{2-}$			54	
	16	16	16	
	81	123		1+
$^{195}_{78}Pt$				

6. Would you expect each of the following atoms to gain or lose electrons when forming ions? What ion is the most likely to form in each case?
   a. Ra b. In c. P d. Te e. Br f. Rb

7. Name each of the following compounds:

a. Rb_2O	f. $TiCl_4$	k. CsF
b. AlI_3	g. CrO_2	l. Li_3N
c. $FeBr_3$	h. Cr_2O_3	m. Ag_2S
d. Hg_2O	i. NaH	n. Sr_3P_2
e. CoS	j. $ZnCl_2$	o. MnO_2

8. Write the formula for each fo the following compounds:

a. Cesium bromide	i. Tin (II) fluoride
b. Barium sulfate	j. ammonium acetate
c. Chlorine monoxide	k. mercury (I) chloride
d. Ammonium chloride	l. Potassium cyanide
e. Silicon tetrachloride	m. Lead (IV) sulfide
f. Beryllium oxide	n. Lead (II) sulfide
g. Sodium dihydrogen phosphate	o. silicon tetrachloride
h. Lithium nitride	p. sodium peroxide

Problem Set 3- Stoichiometry

1. Naturally occurring sulfur consists of four isotopes, ^{32}S(95.0%), ^{33}S(0.76%), ^{34}S(4.22%), and ^{35}S(0.014%). Using these data, calculate the atomic weight of naturally occurring sulfur. The masses of the isotopes are given in the table below.

Isotope	Atomic Mass (amu)
^{32}S	31.91
^{33}S	32.97
^{34}S	33.97
^{35}S	35.97

2. A noble gas consists of three isotopes of masses 19.99amu, 20.99amu, and 21.99amu. The relative abundance of these isotopes is 90.92%, 0.257%, and 8.82% respectively. What is the average atomic mass of this noble gas? What element might this be?

3. An element "X" has five major isotopes, listed below along with their relative abundances. What is this element? Does the atomic mass you calculated based on these data agree with that listed in your periodic table?

Isotope	%Natural Abundance	Atomic Mass
^{46}X	8.0%	45.95269
^{47}X	7.3%	46.951764
^{48}X	73.8%	47.947947
^{49}X	5.5%	48.947841
^{50}X	5.4%	49.944792

4. How many moles are in a sample of 300 atoms of nitrogen? How many grams?

5. If you buy 38.9 moles of M & M's, how many M & M's do you have?

6. A sample of sulfur has a mass of 8.37g. How many moles are in the sample? How many atoms?

7. Give the number of moles of each elements present in 1.0 mole of each of the following substances?
   a. Hg_2I_2
   b. LiH
   c. $PbCO_3$
   d. $Ba_2(AsO_4)_2$
   e. $RbOH \bullet 2H_2O$
   f. H_2SiF_6

8. How many grams of zinc are in 1.16×10^{22} atoms of zinc?

9. Calculate the molar masses of each of the following:
   a. Cu_2SO_4
   b. NH_4OH
   c. $C_{10}H_{16}O$
   d. $Zr(SeO_3)_2$
   e. $Ca_2Fe(CN)_6 \bullet 12H_2O$
   f. $Cr_4(P_2O_7)_3$

10. What is the mass of 4.28×10^{22} molecules of water?

11. How many milligrams of Br_2 are in 4.8×10^{20} molecules of Br_2?

12. How many sodium ions are present in each of the following:
    a. 2 moles of sodium phosphate
    b. 5.8 g of sodium chloride
    c. A mixture containing 14.2 grams of sodium sulfate and 2.9 grams of sodium chloride?

13. Determine the molar mass of $KAl(SO_4)_2 \bullet 12H_2O$.

14. How many moles of cadmium bromide, $CdBr_2$, are in a 39.25 gram sample?

15. Bauxite, the principle ore used in the production of aluminum cans, has a molecular formula of $Al_2O_3 \bullet 2H_2O$.
    a. Determine the molar mass of bauxite.
    b. How many grams of Al are in 0.58 moles of bauxite?
    c. How many atoms of Al are in 0.58 moles of bauxite?
    d. What is the mass in grams of 2.1×10^{24} formula units of bauxite?

16. Calculate the mass percent of Cl in each of the following compounds:
    a. ClF
    b. $HClO_2$
    c. $CuCl_2$
    d. PuOCl

17. Calculate the mass percent of each element in potassium ferricyanide, $K_3Fe(CN)_6$.

18. Calculate the mass percent of silver in each of the following compounds:
    a. AgCl
    b. AgCN
    c. $AgNO_3$

19. Fill in the blanks to balance the following chemical equations:
    a. ____AgI + _____Na_2S → ____Ag_2S + ____NaI
    b. ____$(NH_4)_2Cr_2O_7$ → ____Cr_2O_3 + ____N_2 + _____H_2O
    c. ____Na_3PO_4 + _____HCl → ____NaCl + ____H_3PO_4
    d. ____$TiCl_4$ + _____ H_2O → ____TiO_2 + ____HCl
    e. ____Ba_3N_2 + _____ H_2O → ____$Ba(OH)_2$ + ____NH_3
    f. ____HNO_2 → _____ HNO_3 ____NO + ____H_2O

20. Balance the following equation:
___NH_4OH*(l)* + ___$KAl(SO_4)_2 \bullet 12H_2O$ → ___$Al(OH)_3$*(s)* + ____$(NH_4)_2(SO_4)$ + ____KOH(aq) + ___H_2O*(l)*

21. Balance the following equation:
___Fe*(s)* + ___$HC_2H_3O_2$(*aq*) → ___Fe $(C_2H_3O_2)_2$ *(aq)* + ____H_2*(g)*

22. How many grams of sodium hydroxide are required to form 51.63 g of lead hydroxide?
    $Pb(NO_3)_2$ + NaOH → $Pb(OH)_2$ + $NaNO_3$ (**unbalanced**)

23. How may grams of water vapor can be generated from the combustion of 18.74 g of ethanol?

24. How many grams of potassium iodide are necessary to completely react with 20.61 g of mercury (II) chloride?
    $HgCl_2$ + KI → HgI_2 + KCl (**unbalanced**)

25. How many grams of oxygen are needed to completely react with 22.8g or methane, CH_4. (Please write the entire reaction)

26. If, in the previous problem, only 25.9g of water vapor were formed, how many grams of methane actually reacted with oxygen?

27. What mass of calcium carbonate, $CaCO_3$, would be formed if 248.6g of carbon dioxide, CO_2, were exhaled into limewater, $Ca(OH)_2$,? How many grams of calcium would be needed to form that amount of calcium carbonate? Assume 100% yield in each reaction.

28. The following reaction is used to form lead iodide crystals. What mass of crystal (PbI_2) could be formed from 1.0 x 10^3g of lead (II) acetate [$Pb(C_2H_3O_2)_2$]?

$Pb(C_2H_3O_2)_2 + 2KI \rightarrow PbI_2 + 2KC_2H_3O_2$

29. You were hired by a laboratory to recycle 6 moles of silver ions. You were given 150.g of copper. How many grams of silver can you recover using the following reaction? Is this enough copper to recycle 6 moles of silver ions?

$2\ Ag^+ + Cu \rightarrow 2Ag + Cu^{2+}$

30. If 42.7 g Cr_2O_3 and 9.8 g Al are mixed and reacted until one of the reactants is used via a single replacement reaction,

a. Which reactant is the limiting reactant and which is in excess?

b. How many grams of chromium will be formed?

c. How much excess reactant will be left?

The following problem sets are from the textbook and are optional.

Problem Sets:

Chapter 1: (pages 32-38)

#22, 24, 26, 28, 30, 32, 34, 38, 40, 52, 54, 56, 58, 60, 64, 70, 74, 80, 84, 104, and 106.

Chapter 2: (pages 70-75)

#18, 20, 22, 26, 28, 30, 32, 34, 36, 38, 52, 54, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 88, 96, 98, 104, 106, 108, and 110.

Chapter 3: (pages 119-128)

#26, 28, 30, 32, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 66, 68, 72, 78, 80, 82, 84, 90, 92, 94, 100, 102, 108, 112, 114, 118, 122, 124, 126, 128, 152, 154, 156, and 158.

You will have an exam on this material the 2nd day of class!

Part IV: Signed Safety Contract

Click here for a copy of the safety rules and contract.

Print all pages out and sign the contract and bring on the first day of school.