White Station High School
AP Chemistry **Summer Assignment**: 2026/2027
Instructor: George Richardson

Each student is expected to perform the following **Five** tasks during the summer.

1) **Create** a "**double entry**" summary or study guide for the following three chapters: **Gases, Electrochemistry, and Organic Chemistry. (three chapters)**
   The Summary should include an outline of the chapter (left hand side of the double entry journal) **and** short sentence or phrase for each significant concept, equation, person, etc… (on the right hand side of the double entry journal) *See an example on the reverse side* *(Time: 3 – 5 hours)*
2) **Study** *(Time: 4 – 6 hours)*
   a. **Gas Law:** Know the three fundamental laws: *(review from 1st year chem)* Charles, Boyles, and Avogadro. Know the **combined gas law, ideal gas law, gas stoichiometry**, *(New content for AP Chem)* **Dalton's Partial Pressures, Kinetic Molecular Theory of** gases, **Effusion, Diffusion, and Deviation from ideal gas law behavior (i.e. Real Gases**). **Complete** the attached GAS LAW Problem WS.
   b. **Limiting Reactants** (review from HonorsChem) - Complete the attached WS
   c. **Balancing Equations** (review from HonorsChem) Complete the attached WS
3) **There are Three (3) major concepts in General Chemistry I & II. They are La Chatelier's principle, Intermolecular forces (IMFs), and Coulomb's force of attraction.** You must submit a short paper (500 – 1000 words) on both La Chatelier's Principle **and** Coulomb's Law of Attraction. For IMF's, you must submit a short paper where you discuss each of the four types, AND give a comparison discussion between the four. B**e prepared to present your findings. (**proper MLA citations are expected.) *(Time: 1 – 2 hours) (Yes, there will be a quiz.)*
4) **Oh, Know the names/symbols and charges of the polyatomic ions!**
   Be ready for quiz the first week of class.

Each task will be graded:

a) Double Entry Journal (50 point EXAM grade)
b) Gas Law Problems (20 point Quiz grade)
c) Limiting Reactants Problems (20 point Homework grade)
d) Balancing Equations (20 point Homework grade)
e) Short paper discussion and presentation (50 point LAB grade).
f) Polyatomic Quiz(s) – First week of class (20 point Quiz grade)

Double Entry Journal and Short papers are due the first day of class. Note: I will **NOT** accept **ANY** late work for *full credit*.

My goal is to spend a bare minimum of time reviewing the basics and stuff you should already know and get through "gas law's" which are relatively easy. I want to move through the first part of the book rapidly. Your journal for the chapters will facilitate this process.

I look forward to an exciting 2026/2027 AP Chemistry class! Thank you.

Below is a "link" to an AP Chemistry text book, which you may use for the above assignments. Or find your own reference material…

https://1drv.ms/b/c/504c3c2686d65af5/IQD1WtaGJjxMIIBQ_LcAAAAAASSiZglzyNTry7a8WsaWY9M?e=3MOGcO

This is *an* ***example of*** a double entry journal
(Note: the content on left - matches up with the comments on the right.)

Zumdahl, 8th ed.

Chapter 15: Application of Acid/Base Equilibrium

1. Solutions – common ions - - - - - - - - - - - - >
2.

    a. Common ions - - - - - - - - - >

    b. Common ion effect

    c. Equilibrium concentrations

3. Buffer solutions

    a. Definition – A solution that resists a change in the pH.

4. Buffer capacity
5. Titration and titration curves

ETC…….

This is a continuation of acid/base chapter, adding a new demotion of common ions and more complex applications of the ICE box method.

Common ion is an ions (ions are charged species) that is present in two different disassociation reactions within the same solution. Example: a weak acid only partially dissociates, into "ions", thus there is un-dissolved acid AND H+ and conjugate base ions in solution. A second reaction adds a common ion (likely the conjugate base ion) Thus the equilibrium is shifted.

An application of the "Le Chatelier" principle where the equilibrium concentrations are shifted to release "strain".

Using the ICE box methods used for weak acids/bases (Chapter 14) determine the equilibrium concentrations with the addition of "common" ions. Thus, the starting concentrations of the "products" will not necessarily start as zero.

ETC……

Polyatomic ions, know the symbols, charges and names. **This is basic vocabulary for chemistry.**

Symbols and Charges for Polyatomic Ions

Formula	Name	Formula	Name
NO_3^-	nitrate	ClO_4^-	perchlorate
NO_2^-	nitrite	ClO_3^-	chlorate
CrO_4^{2-}	chromate	ClO_2^-	chlorite
$Cr_2O_7^{2-}$	dichromate	ClO^-	hypochlorite
CN^-	cyanide	IO_4^-	periodate
MnO_4^-	permanganate	IO_3^-	iodate
OH^-	hydroxide	IO^-	hypoiodite
O_2^{2-}	peroxide	BrO_3^-	bromate
NH_2^-	amide	BrO^-	hypobromite
CO_3^{2-}	carbonate	HCO_3^-	hydrogen carbonate (bicarbonate)
SO_4^{2-}	sulfate	HSO_4^-	hydrogen sulfate (bisulfate)
SO_3^{2-}	sulfite	HSO_3^-	hydrogen sulfite (bisulfite)
$C_2O_4^{2-}$	oxalate	$HC_2O_4^-$	hydrogen oxalate (binoxalate)
PO_4^{3-}	phosphate	HPO_4^{2-}	hydrogen phosphate
PO_3^{3-}	phosphite	$H_2PO_4^-$	dihydrogen phosphate
$S_2O_3^{2-}$	thiosulfate	HS^-	hydrogen sulfide
AsO_4^{3-}	arsenate	BO_3^{3-}	borate
SeO_4^{2-}	selenate	$B_4O_7^{2-}$	tetraborate
SiO_3^{2-}	silicate	SiF_6^{2-}	hexafluorosilicate
$C_4H_4O_6^{2-}$	tartrate	SCN^-	thiocyanate
$C_2H_3O_2^-$	acetate (an alternate way to write acetate is CH_3COO^-)		
HCO_2^-	formate		

There is one positive polyatomic ion. It is NH_4^+ and is called the ammonium ion. Note: Writing just the plus sign or minus sign for ions with +1 or -1 charges is acceptable.

Also: NH_4^+ is ammonium ion, and CHO_2^- is formate ion (CHO_2H is formic acid)

Oh, you should know these too!!

Symbols and Charges for Monatomic Ions

Fixed Charge

SYMBOL	NAME
1+	
H^+	Hydrogen
Li^+	Lithium
Na^+	Sodium
K^+	Potassium
Rb^+	Rubidium
Cs^+	Cesium
Ag^+	Silver
2+	
Be^{2+}	Beryllium
Mg^{2+}	Magnesium
Ca^{2+}	Calcium
Cd^{2+}	Cadmium
Sr^{2+}	Strontium
Ba^{2+}	Barium
Zn^{2+}	Zinc
3+	
Al^{3+}	Aluminum
Bi^{3+}	Bismuth
La^{3+}	Lanthanum

SYMBOL	NAME
1-	
H^-	Hydride
F^-	Fluoride
Cl^-	Chloride
Br^-	Bromide
I^-	Iodide
2-	
O^{2-}	Oxide
S^{2-}	Sulfide
Se^{2-}	Selenide
Te^{2-}	Telluride
3-	
N^{3-}	Nitride
P^{3-}	Phosphide
As^{3-}	Arsenide
4-	
C^{4-}	Carbide

Note that the letters in an ion's name before the **-ide** ending is the stem.
For example, the stem for bromide is **brom-**.

Symbols and Charges for Monatomic Ions

Variable Charge

Symbol	Systematic name		Symbol	Systematic name	
	(Stock system)	Common name		(Stock system)	Common name
Cr^{2+}	Chromium (II)	Chromous	Pb^{4+}	Lead (IV)	Plumbic
Cr^{3+}	Chromium (III)	Chromic	Mn^{2+}	Manganese (II)	Manganous
Co^{2+}	Cobalt (II)	Cobaltous	Mn^{3+}	Manganese (III)	Manganic
Co^{3+}	Cobalt (III)	Cobaltic	Hg_2^{2+}	Mercury (I)	Mercurous
Cu^+	Copper (I)	Cuprous	Hg^{2+}	Mercury (II)	Mercuric
Cu^{2+}	Copper (II)	Cupric	Ni^{2+}	Nickel (II)	Nickelous
Fe^{2+}	Iron (II)	Ferrous	Ni^{3+}	Nickel (III)	Nickelic
Fe^{3+}	Iron (III)	Ferric	Sn^{2+}	Tin (II)	Stannous
Au^+	Gold (I)	Aurous	Sn^{4+}	Tin (IV)	Stannic
Au^{3+}	Gold (III)	Auric	V^{2+}	Vanadium (II)	Vanadous
Pb^{2+}	Lead (II)	Plumbous	V^{3+}	Vanadium (III)	Vanadic

AP Chemistry Summer Work – GAS LAW Problems

Name:_____ Date Submitted:_____

Period:____

*(Note: You **must show ALL WORK** and justifications of your answer. Must have correct sig figs, and units)*

1. On a hot sunny day in August, the weatherman reports that the barometric pressure is 36 atm (atmospheres). How many Pascals is this? Answer in units of Pascals
2. Suppose that a sample of gas occupies 83 mL of volume at 25°C and a pressure of 242 torr. What would be the volume if the pressure were changed to 502 torr at 25°C? Answer in units of mL
3. A 1.50 liter tank filled with helium at 125 atm is used to fill balloons. The pressure in each balloon is 950 torr and the volume of each balloon is 1.20 liters. How many balloons can be filled? Answer in units of balloons
4. To what temperature must a sample of helium gas be cooled from 130°C to reduce its volume from 3.2 L to 0.48 L at constant pressure? Answer in units of K
5. A sample of gas occupies 5 mL at STP. At what pressure would this sample occupy 500 mL if the temperature is changed to 525°C? Answer in units of torr.
6. What is the density of hydrogen sulfide (H_2S) at 1.7 atm and 277 K? Answer in units of g/L
7. What pressure would a mixture of 3.2 grams of O_2, 6.4 grams CH_4, and 6.4 grams of SO_2 exert if the gases were placed in a 4.2 liter container at 127°C? Answer in units of atm
8. Jeff and Jill go canoeing. While reaching to feed a duck, the boat flips. Jeff and Jill blow up their inflatable life preservers and then put them on. As they wait for the rescue squad, they calculate how much nitrogen is in each life preserver. They estimate that the volume is 14 L, pressurized to 1.4 atm at 25°C. The air used for inflation is 80% nitrogen by volume and 20% oxygen by volume. Give the amount of nitrogen gas. Answer in units of gram
9. We mix 119 grams of oxygen gas with 176 grams of argon gas in a volume of 520 mL at 116°C. What will be the final pressure of the gas mixture? Answer in units of atm
10. A 8.4 gram sample of a gaseous substance occupies 16 L at 24°C and 596 torr. What is the density of the gas under these conditions? Answer in units of g/L
11. We observe that 8 grams of a gaseous compound occupies 2099 mL at 52°C and 693 torr. What is the molecular weight of the compound? Answer in units of g/mol
12. We drop 36.1 grams of magnesium into 474 mL of a 4 M HCl solution. What is the maximum volume of dry hydrogen that could be produced by this reaction at STP? $Mg(s) + 2HCl(aq) \rightleftharpoons MgCl_2(aq) + H_2(g)$ Answer in units of liters
13. An apparatus consists of a 2 L flask containing nitrogen gas at 27°C and 709 kPa, joined by a valve to a 7 L flask containing argon gas at 27°C and 42.9 kPa. The valve is opened and the gases mix. What is the partial pressure of nitrogen after mixing? Answer in units of kPa
14. What is the partial pressure of argon after mixing? Answer in units of kPa
15. What is the total pressure of the gas mixture? Answer in units of kPa
16. A 322 mL sample of nitrogen (N_2) was collected by displacement of water at 24°C under a total barometric pressure of 573 torr. What mass of dry nitrogen was collected? The vapor pressure of water at 24°C is 22 torr. Answer in units of g
17. The rate of effusion of unknown gas X is found to be about 1.7 times that of SF_6 gas (MW = 146 g/mol) at the same conditions of temperature and pressure. What is the molecular weight of gas X? Answer in units of g/mol

AP Chemistry - Summer Work: 2026/27 Limiting Reagent Problems

Name:_____ Date Submitted:_____ Period: _____

Note: You must show ALL WORK, and justify (prove) every answer. ie. T-Charts!

1. 15.00 g aluminum sulfide and 10.00 g water react until the limiting reagent is used up. Here is the balanced equation for the reaction: $Al_2S_3 + 6\ H_2O$ ----------> $2Al(OH)_3 + 3\ H_2S$

(A) Which is the limiting reagent?

(B) What is the maximum mass of H_2S which can be formed from these reagents?

(C) How much excess reagent remains after the reaction is complete?

2. Given the following equation: $2\ KClO_3$ ---> $2\ KCl + 3\ O_2$

How many moles of O_2 can be produced by letting 12.00 moles of $KClO_3$ react?

3. Given the following equation: $2\ K + Cl_2$ ---> $2\ KCl$

How many grams of KCl is produced from 2.50 g of K and 1.00 g of Cl_2 ?

4. Given the following equation: $Na_2O + H_2O$ ---> $2\ NaOH$

How many grams of NaOH is produced from 1.20×10^2 grams of Na_2O? How many grams of Na_2O are required to produce 1.60×10^2 grams of NaOH?

5. Given the following equation: $8\ Fe + S_8$ ---> $8\ FeS$

What mass of iron is needed to react with 16.0 grams of sulfur? How many grams of FeS are produced?

6. Given the following equation: $2\ NaClO_3$ ---> $2\ NaCl + 3\ O_2$

12.00 moles of $NaClO_3$ will produce how many grams of O_2? How many grams of NaCl are produced when 80.0 grams of O_2 are produced?

7. Given the following equation: $Cu + 2\ AgNO_3$ ---> $Cu(NO_3)_2 + 2\ Ag$

How many moles of Cu are needed to react with 3.50 moles of $AgNO_3$? If 89.5 grams of Ag were produced, how many grams of Cu reacted?

8. Molten iron and carbon monoxide are produced in a blast furnace by the reaction of iron(III) oxide and coke (pure carbon). If 25.0 kilograms of pure Fe_2O_3 and 6.50 grams of C are used, how many kilograms of iron can be produced? The reaction is: $Fe_2O_3 + 3\ C$ ---> $2\ Fe + 3\ CO$

9. Given the reaction: $4\ NH_3\ (g) + 5\ O_2\ (g)$ ---> $4\ NO\ (g) + 6\ H_2O\ (l)$

When 1.20 mole of ammonia reacts, the total number of moles of products formed is:

a. 1.20 b. 1.50 c. 1.80 d. 3.00 e. 12.0 AND Explain why?

10. Determine moles of Na_2S that can be prepared by the reaction of 0.2240 moles of sodium with 0.1320 moles of sulfur. Which reactant is the limiting factor?

$16\ Na + S_8$ ---> $8\ Na_2S$

11. Disulfur dichloride, S_2Cl_2, is used to vulcanize rubber. It can be made by treating molten sulfur with gaseous chlorine: $S_8(l) + 4\ Cl_2(g) \rightarrow 4\ S_2Cl_2(l)$

Starting with a mixture of 32.0 g of sulfur and 71.0 g of Cl_2, which is the limiting reactant? What mass of S_2Cl_2 (in grams) can be produced? What mass of the excess reactant remains when the limiting reactant is consumed?

12. Aspirin ($C_9H_8O_4$) is produced by the reaction of salicylic acid ($C_7H_6O_3$) and acetic anhydride ($C_4H_6O_3$). $C_7H_6O_3(s) + C_4H_6O_3(l) \rightarrow C_9H_8O_4(s) + CH_3CO_2H(aq)$

    If you mix 100. g of each of the reactants, what is the maximum mass of aspirin that can be obtained?

13. Disulfur dichloride, which has a revolting smell, can be prepared by directly combining S8 and Cl2, but it can also be made by the following reaction:

    $$3\ SCl_2(l) + 4\ NaF(s) \rightarrow SF_4(g) + S_2Cl_2(l) + 4\ NaCl(s)$$

    Assume you begin with 5.23 g of SCl_2 and excess NaF. What is the theoretical yield of S_2Cl_2? If only 1.19 g of S_2Cl_2 is obtained, what is the percent yield of the compound?

14. Hydrazine reacts with dinitrogen tetroxide according to the equation:

    $$2N_2H_4(g) + N_2O_4(g) \rightarrow 3N_2(g) + 4H_2O(g)$$

    50.0 grams of hydrazine is mixed with 100.0 grams of dinitrogen tetroxide. How much nitrogen gas was produced?

General Chemistry I - Fall 2026 - Richardson
Balancing Worksheet **Name:_____ Date:_____**

Balance the following reactions. (Note: several of these equations are already balanced). **Circle any polyatomic ions and write their name**. There are 50 problems in two columns

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1. $H_2 + O_2 \rightarrow H_2O$
2. $S_8 + O_2 \rightarrow SO_3$
3. $HgO \rightarrow Hg + O_2$
4. $Zn + HCl \rightarrow ZnCl_2 + H_2$
5. $Na + H_2O \rightarrow NaOH + H_2$
6. $C_{10}H_{16} + Cl_2 \rightarrow C + HCl$
7. $Si_2H_3 + O_2 \rightarrow SiO_2 + H_2O$
8. $Fe + O_2 \rightarrow Fe_2O_3$
9. $C_7H_6O_2 + O_2 \rightarrow CO_2 + H_2O$
10. $FeS_2 + O_2 \rightarrow Fe_2O_3 + SO_2$
11. $Fe_2O_3 + H_2 \rightarrow Fe + H_2O$
12. $K + Br_2 \rightarrow KBr$
13. $C_2H_2 + O_2 \rightarrow CO_2 + H_2O$
14. $H_2O_2 \rightarrow H_2O + O_2$
15. $C_7H_{16} + O_2 \rightarrow CO_2 + H_2O$
16. $SiO_2 + HF \rightarrow SiF_4 + H_2O$
17. $KClO_3 \rightarrow KCl + O_2$
18. $KClO_3 \rightarrow KClO_4 + KCl$
19. $P_4O_{10} + H_2O \rightarrow H_3PO_4$
20. $Sb + O_2 \rightarrow Sb_4O_6$
21. $C_3H_8 + O_2 \rightarrow CO_2 + H_2O$
22. $Fe_2O_3 + CO \rightarrow Fe + CO_2$
23. $PCl_5 + H_2O \rightarrow HCl + H_3PO_4$
24. $H_2S + Cl_2 \rightarrow S_8 + HCl$
25. $Fe + H_2O \rightarrow Fe_3O_4 + H_2$
26. $N_2 + H_2 \rightarrow NH_3$
27. $N_2 + O_2 \rightarrow N_2O$
28. $CO_2 + H_2O \rightarrow C_6H_{12}O_6 + O_2$
29. $SiCl_4 + H_2O \rightarrow H_4SiO_4 + HCl$
30. $H_3PO_4 \rightarrow H_4P_2O_7 + H_2O$
31. $CO_2 + NH_3 \rightarrow OC(NH_2)_2 + H_2O$
32. $Al(OH)_3 + H_2SO_4 \rightarrow Al_2(SO_4)_3 + H_2O$
33. $Fe_2(SO_4)_3 + KOH \rightarrow K_2SO_4 + Fe(OH)_3$
34. $H_2SO_4 + HI \rightarrow H_2S + I_2 + H_2O$
35. $Al + FeO \rightarrow Al_2O_3 + Fe$
36. $Na_2CO_3 + HCl \rightarrow NaCl + H_2O + CO_2$
37. $P_4 + O_2 \rightarrow P_2O_5$
38. $K_2O + H_2O \rightarrow KOH$
39. $Al + O_2 \rightarrow Al_2O_3$
40. $Na_2O_2 + H_2O \rightarrow NaOH + O_2$
41. $C + H_2O \rightarrow CO + H_2$
42. $H_3AsO_4 \rightarrow As_2O_5 + H_2O$
43. $Al_2(SO_4)_3 + Ca(OH)_2 \rightarrow Al(OH)_3 + CaSO_4$
44. $FeCl_3 + NH_4OH \rightarrow Fe(OH)_3 + NH_4Cl$
45. $Ca_3(PO_4)_2 + SiO_2 \rightarrow P_4O_{10} + CaSiO_3$
46. $N_2O_5 + H_2O \rightarrow HNO_3$
47. $Al + HCl \rightarrow AlCl_3 + H_2$
48. $H_3BO_3 \rightarrow H_4B_6O_{11} + H_2O$
49. $Mg + N_2 \rightarrow Mg_3N_2$
50. $NaOH + Cl_2 \rightarrow NaCl + NaClO + H_2O$