

AP Chemistry Review/ Summer Assignment Part 1 (Prepared by L.B. Petersen, adopted by Mr. Eksi)

Welcome to AP Chemistry! We are looking forward to an amazing year- in this class you will be pushed to your best every day and we will work as a team toward our goal of getting a 5 in the AP Chemistry exam in May.

- This is the **first part of your summer homework**, make sure to complete the second one too.
- Make sure that you **show your work**, use dimensional analysis when appropriate.
- You can use another separate paper, if you need extra space.

What You Need to Know	Resources
Math Skills <input type="checkbox"/> Significant Figures <input type="checkbox"/> Scientific Notation <input type="checkbox"/> Density Calculations <input type="checkbox"/> Metric Conversions <input type="checkbox"/> Unit Analysis	KcoolScience YouTube Channel <ul style="list-style-type: none"> • Chemistry Fundamentals: Math Skills Worksheet 0.1 and 0.2
Naming and Writing Chemical Compounds <input type="checkbox"/> Common element names and symbols <input type="checkbox"/> Charges of basic ions <input type="checkbox"/> Names, symbols, and charges of polyatomic ions <input type="checkbox"/> Ionic names and formulas	KcoolScience YouTube Channel <ul style="list-style-type: none"> • Chemistry Fundamentals: Ionic and Covalent Names and Formulas Quizlet Sets- Elements, Ions, and Polyatomics <ul style="list-style-type: none"> • https://quizlet.com/join/a4H8nYxQS Worksheet 0.3 and 0.4
Reactions & Stoichiometry <input type="checkbox"/> Balancing Chemical Reactions <input type="checkbox"/> Five main types of reactions <input type="checkbox"/> Molar Mass of Compounds <input type="checkbox"/> Mole Ratios <input type="checkbox"/> Multi-step Conversions <input type="checkbox"/> Limiting Reactants	KcoolScience YouTube Channel <ul style="list-style-type: none"> • Chemistry Concepts: Stoichiometry Worksheet 0.5 and 0.6
Electron Structures <input type="checkbox"/> Valence Electrons <input type="checkbox"/> Bohr Models <input type="checkbox"/> Behavior of Electrons in Bond Types <input type="checkbox"/> Simple Lewis Structures	KcoolScience Youtube Channel <ul style="list-style-type: none"> • Chemistry Concepts: The Periodic Table and Electrons Worksheet 0.7

0.1 Math Skills 1**Part 1: Significant Figures**

What are significant figures? How do they apply when making measurements? When doing calculations?

Make the following calculations, rounding off to the correct number of significant figures:

Ex.) $2.6 \times 3.78 = 9.828 \rightarrow \boxed{9.8}$

Ex) $4.51 - 2.1395 = 2.3705 \rightarrow \boxed{2.4}$

1. $2.31 + 9.1028 =$

6. $2451.1 - 2450. =$

2. $891.5 - 402 =$

7. $0.0036 \times 0.02 =$

3. $3.15 \times 2.5 \times 4.00 =$

8. $0.075 / 0.030 =$

4. $40.8 / 5.05 =$

9. $102 \times 0.1924 =$

5. $312 - 100 =$

10. $5,600 \times 12.31 =$

Part 2: Scientific Notation

Scientific Notation is used as shorthand for scientists. Why? And how does it work?

Answer these questions in your own words:

Convert these numbers from scientific notation to standard notation. Then perform the calculations using your calculator.

Scientific	Standard
2.3×10^{-3}	
	465,000
	0.00187
8.20×10^6	
	0.000091
3.12×10^2	
	1,102,000
7.102×10^{-7}	

1. $(2.31 \times 10^3)(1.25 \times 10^5) =$

2. $(1.64 \times 10^{-6})(8.91 \times 10^{11}) =$

3. $(3.5 \times 10^{-4})(1.2 \times 10^{-5}) =$

4. $(7.1 \times 10^3) / (1.2 \times 10^5) =$

5. $(2.10 \times 10^{-4}) / (1.32 \times 10^6) =$

6. $(9.23 \times 10^8) / (3.12 \times 10^6) =$

Part 3: Metric Conversions

The metric system is very useful and it used almost exclusively in science. Why is it so useful? What are the “major” metric conversions and equalities you should know?

Answer these questions in your own words:

Solve the following metric conversions:

- | | | |
|----------------------|----------------------|-----------------------|
| 1) 2000 mg = _____ g | 6) 5.0 L = _____ ml | 11) 16 cm = _____ m |
| 2) 104 km = _____ m | 7) 198 g = _____ kg | 12) 2500 m = _____ km |
| 3) 480 cm = _____ m | 8) 75 mL = _____ L | 13) 65.0 g = _____ mg |
| 4) 5.6 kg = _____ g | 9) 50.0 cm = _____ m | 14) 6.3 cm = _____ m |
| 5) 8.2 mm = _____ cm | 10) 5.6 m = _____ cm | 15) 120 mg = _____ g |

Part 4: Unit Analysis

Unit Analysis is used a lot in this class. Why is it convenient? What is it used for?

Answer these questions in your own words:

- 1) Convert 63 mph to km/hr?

- 2) What is 45 m/s in mph? (1,609m = 1 mi)?

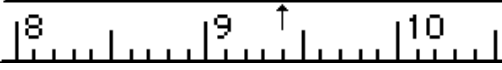
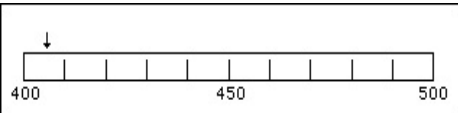
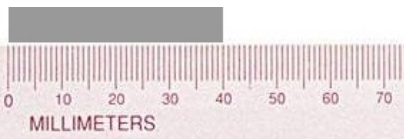
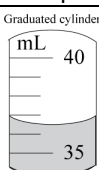
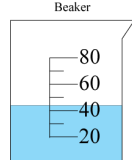
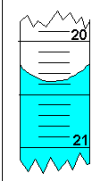
- 3) If a snail moves 4 cm/ min, what is that in km/hr?

- 4) If I run 1 km in 20 min, how many meters per second in that?

0.2- Math Skills 2- Measurements & Density

Part 1: Measurements

1. Indicate each measurement to the correct number of sig figs.

example	answer
	_____ cm
	_____ cm
	_____ mm
	_____ mL
	_____ mL
	_____ mL

Part 2: Density

2. What is the relationship between a cubic centimeter, cm^3 , and a milliliter, mL?

3. What is the density of water?

4. Solve each of the following using the density equation.

work	mass	vol	Density
	3.5 g	4.0 mL	
	1.5 g		6.0 g/mL
		2.0 mL	10. g/mL

work	mass	vol	Density
	33.5 g	800.0 mL	
	17.5 g		2.0 g/cm ³
		5.0 mL	0.50 g/cm ³

5. Calculate the thickness of the unknown sheet of metal given the data below.

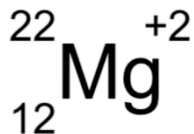
density of the unknown metal	8.50 g/cm ³
mass of unknown metal sheet sample	44.50 g

length of unknown metal	12.40 cm
width of unknown metal	21.50 cm

0.3 Atoms & Ions

Part 1: Isotope Notation

1. Label the example of isotope notation with what each number means. Then, fill out the chart.



Magnesium- 22

symbol	alternate symbol	neutrons	protons	electrons	atomic number	mass number
${}^{31}_{15}\text{P}$						
	C-14					
${}^{28}_{13}\text{Al}^{+3}$						
				38	38	87
		16	15	15		
						20

Part 2: Valence Electrons & Ion Formation

Element	Number of Valence Electrons	Lose or Gain _____ Electrons	Cation or Anion?	Ion Formed
<i>Ex. Lithium</i>	<i>1</i>	<i>Lose 1 e</i>	<i>Cation</i>	<i>Li⁺</i>
Magnesium				
Nitrogen				
Aluminum				
Chlorine				
Oxygen				
Phosphorous				

Part 4: Polyatomic Ions

Unfortunately, no tips here. Memorize the 16 highlighted polyatomic ions & transition metal charges.

Transition metal charges to memorize:

- $\text{Cu}^{2+}/\text{Cu}^{3+}$
- $\text{Fe}^{2+}/\text{Fe}^{3+}$
- Zn^{2+}
- Ag^{+}
- $\text{Sn}^{4+}/\text{Sn}^{2+}$
- $\text{Pb}^{2+}/\text{Pb}^{4+}$

Polyatomic ions to memorize:

- Acetate
- Bromate
- Carbonate
- Chlorate
- Dichromate
- Hydroxide
- Iodate
- Nitrate
- Permanganate
- Peroxide
- Phosphate
- Sulfate
- Thiocyanate
- Thiosulfate
- Ammonium
- Hydronium

*though you are memorizing the -ates, you should also be able to determine the per- -ates, -ites, and hypo- -ites, using the rule below.

TABLE OF POLYATOMIC IONS												PERIODIC TABLE OF IONS							
acetate	CH_3COO^-	dihydrogen phosphate	H_2PO_4^-	perchlorate	ClO_4^-	oxalate	$\text{C}_2\text{O}_4^{2-}$	PERIODIC TABLE OF IONS KEY: atomic number → 26, Fe ³⁺ → ion charge, Fe ³⁺ → ion name (IUPAC), Fe ²⁺ → iron (II)											
arsenate	AsO_4^{3-}	hydrogen carbonate	HCO_3^-	periodate	IO_4^-	perchlorate	ClO_4^-												
arsenite	AsO_3^{3-}	hydrogen oxalate	HC_2O_4^-	permanganate	MnO_4^-	peroxide	O_2^{2-}	13 14 15 16 17 18 B C N ³⁻ O ²⁻ F ⁻ Ne boron carbon nitride oxide fluoride neon 13 14 15 16 17 18 Al ³⁺ Si p ³⁻ S ²⁻ Cl ⁻ Ar aluminum silicon phosphide sulfide chloride argon											
benzoate	$\text{C}_6\text{H}_5\text{COO}^-$	hydrogen sulfate	HSO_4^-	peroxide	O_2^{2-}	phosphate	PO_4^{3-}												
borate	BO_3^{3-}	hydrogen sulfide	HS^-	pyrophosphate	$\text{P}_2\text{O}_7^{4-}$	sulfate	SO_4^{2-}												
bromate	BrO_3^-	hydrogen sulfite	HSO_3^-	sulfite	SO_3^{2-}	thiosulfate	$\text{S}_2\text{O}_3^{2-}$												
carbonate	CO_3^{2-}	hydroxide	OH^-	thiocyanate	SCN^-	ammonium	NH_4^+												
chlorate	ClO_3^-	hypochlorite	ClO^-	thiosulfate	$\text{S}_2\text{O}_3^{2-}$	hydronium	H_3O^+												
chlorite	ClO_2^-	iodate	IO_3^-	POSITIVE POLYATOMIC IONS															
chromate	CrO_4^{2-}	monohydrogen phosphate	HPO_4^{2-}	ammonium	NH_4^+	hydronium	H_3O^+												
cyanate	CNO^-	nitrate	NO_3^-	hydroxide	OH^-	hypochlorite	ClO^-												
cyanide	CN^-	nitrite	NO_2^-	iodate	IO_3^-	iodite	IO_2^-												
dichromate	$\text{Cr}_2\text{O}_7^{2-}$	orthosilicate	SiO_4^{4-}	iodite	IO_2^-	hypochlorite	ClO^-												

Rule	Example
per + "root" + ate	perchlorate ClO_4^-
"root" + ate	chlorate ClO_3^-
"root" + ite	chlorite ClO_2^-
hypo + "root" + ite	hypochlorite ClO^-

60	61	62	63	64	65	66	67	68	69	70	71
Nd ³⁺ neodymium	Pm ³⁺ promethium	Sm ³⁺ samarium(II)	Eu ³⁺ europium(III)	Gd ³⁺ gadolinium	Tb ³⁺ terbium	Dy ³⁺ dysprosium	Ho ³⁺ holmium	Er ³⁺ erbium	Tm ³⁺ thulium	Yb ³⁺ ytterbium(III)	Lu ³⁺ lutetium
92	93	94	95	96	97	98	99	100	101	102	103
U ⁶⁺ uranium(VI)	Np ⁵⁺ neptunium	Pu ⁴⁺ plutonium(VI)	Am ³⁺ americium(III)	Cm ³⁺ curium	Bk ³⁺ berkelium(III)	Cf ³⁺ californium	Es ³⁺ einsteinium	Fm ³⁺ fermium	Md ²⁺ mendelevium(II)	No ²⁺ nobelium(II)	Lr ³⁺ lawrencium

0.4 Ionic Formulas

1. Find the formula of the ionic bond. First identify the ions formed, write the formula of the ionic compound that would form from the two elements, and name it.

Elements	Ions Involved		Chemical Formula	Name of Compound
	Cation (Metal)	Anion (Nonmetal)		
Ex. Magnesium and Fluorine	Mg ²⁺	F ⁻	MgF ₂	Magnesium Fluoride
Lithium and Bromine				
Calcium and Oxygen				
Potassium and Nitrogen				
Sodium and Chlorine				
Calcium and Hydroxide				
Sodium and Phosphate				
Potassium and Nitrate				

2. Fill out the chart below and show the chemical formulas for the ionic compounds.

	O ²⁻	F ⁻	OH ⁻	CO ₃ ²⁻	PO ₄ ³⁻
Na ⁺	Ex. Na ₂ O				
Ca ²⁺					
Fe ²⁺					
Fe ³⁺					
NH ₄ ⁺					

3. Complete the following ionic compound names and/or formulas

**Roman numbers refer to charges, for example iron (III) is Fe³⁺, Tin (II) refers to Sn²⁺*

name	formula
Magnesium Chloride	
	Ca(NO ₃) ₂
Sodium Fluoride	
	Na ₂ O
iron(III) carbonate	
	CuO
lead(II) iodide	

name	formula
	Cu(OH) ₂
tin(II) sulfate	
	NiCO ₃
ammonium nitrate	
	NaCH ₃ COO
lead(II) phosphate	
	AgNO ₃

4. Name the following ionic compounds.

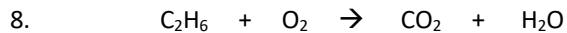
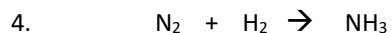
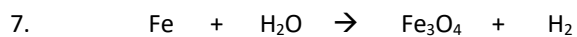
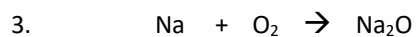
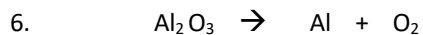
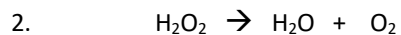
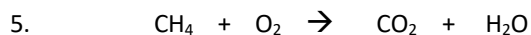
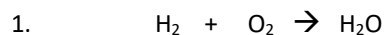
- | | |
|----------------------------------|--|
| ▪ Na_2CO_3 _____ | ▪ PbO _____ |
| ▪ NaOH _____ | ▪ Li_3PO_4 _____ |
| ▪ MgBr_2 _____ | ▪ TiI_4 _____ |
| ▪ KCl _____ | ▪ Co_3N_2 _____ |
| ▪ FeCl_2 _____ | ▪ Mg_3P_2 _____ |
| ▪ FeCl_3 _____ | ▪ $\text{Ga}(\text{NO}_2)_3$ _____ |
| ▪ $\text{Zn}(\text{OH})_2$ _____ | ▪ Ag_2SO_3 _____ |
| ▪ Be_2SO_4 _____ | ▪ NH_4OH _____ |
| ▪ CrF_2 _____ | ▪ $\text{Al}(\text{CN})_3$ _____ |
| ▪ Al_2S_3 _____ | ▪ $\text{Be}(\text{CH}_3\text{COO})_2$ _____ |

5. Determine the following ionic formulas.

- | | |
|-----------------------------|--------------------------------|
| • sodium phosphide _____ | • gallium nitride _____ |
| • magnesium nitrate _____ | • iron (II) bromide _____ |
| • lead (II) sulfite _____ | • vanadium (V) phosphate _____ |
| • calcium phosphate _____ | • calcium oxide _____ |
| • ammonium sulfate _____ | • magnesium acetate _____ |
| • silver cyanide _____ | • aluminum sulfate _____ |
| • aluminum sulfide _____ | • copper (I) carbonate _____ |
| • beryllium chloride _____ | • barium oxide _____ |
| • copper (I) arsenide _____ | • ammonium sulfite _____ |
| • iron (III) oxide _____ | • silver bromide _____ |

0.4 Chemical Reactions**Part 1: Balancing Reactions**

Write in the coefficients to balance the reactions below.

**Part 2: Types of Reactions**

Complete the chart below and use these categories to classify the reactions in part 3.

Type of Reaction	Description	Example
Synthesis		
	Reaction in which one compound breaks down into 2 or more atoms or smaller compounds	
		$3 \text{CuCl}_2 (\text{aq}) + 2 \text{Al} (\text{s}) \rightarrow 2 \text{AlCl}_3 (\text{aq}) + 3 \text{Cu} (\text{s})$ <i>Aqueous copper (II) chloride reacts with aluminum metal to produce aqueous aluminum chloride and solid copper.</i>
	Reaction in which two ionic compounds "swap partners"	
Combustion of a hydrocarbon		

0.5 Stoichiometry Basics

Part 1: Finding Molar Mass

Find the molar mass of each of the following compounds. Show work (don't just google them unless its to check!)

1. Nitrogen gas: N_2
2. Calcium Hydroxide: $Ca(OH)_2$
3. Ammonia: NH_3
4. Nickel nitrate: $Ni(NO_3)_2$
5. Copper (II) Chloride: $CuCl_2$
6. Sucrose (table sugar): $C_{12}H_{22}O_{11}$

Part 2: Converting Between Grams and Moles

Convert between mass and moles using dimensional analysis.

element or compound	mass	moles	work
Cl_2	1.00 g		
CO_2		2.51 mol	
$NaCl$	1.50 g		
CH_4		.75 mol	

element or compound	mass	moles	work
O_2	1.00 g		
H_2O		2.51 mol	
$NaCl$		0.045 mol	
$C_6H_{12}O_6$		1.5 mol	

Part 3: Mole Ratios

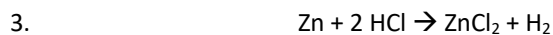
Use the balanced reaction and mole ratio to answer the following questions.



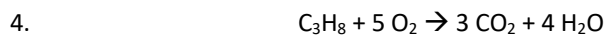
How many moles of H_2 are needed to completely react with 2 moles of N_2 ?



How many moles of O_2 would be produced if 6 moles of $KClO_3$ were used?



How many moles of H_2 are produced when 3 moles of Zn are reacted with an excess of HCl ?



How many moles of O_2 are needed to completely react with 4 moles of C_3H_8 ?



How many moles of KNO_3 are produced when 2 moles of K_3PO_4 are reacted with 2 moles of $Al(NO_3)_3$? Which is the limiting reagent?

0.6 Stoichiometry

1. Write the balanced equation below then use the mole ratio to complete all calculations.

Hydrogen peroxide decomposes in to water and oxygen gas.
write the balanced equation here:

H_2O_2	H_2O	O_2
1 mole H_2O_2 consumed		
	3 moles H_2O produced	
		2 moles O_2 produced

example	work	answer
3.0 grams of H_2O_2 decomposes in sunlight. Find the grams of H_2O produced.		
3.0 grams of O_2 was produced in this reaction. Find the grams of H_2O produced.		
3.0 grams of H_2O was produced in this reaction. Find the grams of H_2O_2 consumed.		

2. Write the balanced equation below then use the mole ratio to complete all calculations.

Potassium metal reacts with chlorine gas producing potassium chloride.
write the balanced equation here:

example	work	answer
2.5 grams of K was exposed to 2.5 grams of Cl_2 . Which reactant was in excess?		
How many grams of potassium chloride will form?		
How many grams of the excess reactant will be left unreacted?		

3. Write the balanced equation below then use the mole ratio to complete all calculations.

Solid sodium + water yields hydrogen gas and sodium hydroxide.
write the balanced equation here:

example	work	answer
1.0 gram of Na was added to 4.0 gram of water. Find the limiting reactant.		
Using the limiting reactant, find the grams of the other reactant consumed.		
Using the limiting reactant, find the grams of NaOH produced.		
Using the grams of NaOH produced, find the grams of H ₂ produced.		
Using the limiting reactant, find the grams of H ₂ produced.		

4. Write the balanced equation below then use the mole ratio to complete all calculations.

Ethane (C₂H₆) burns in the presence of O₂(g), yielding CO₂(g) and H₂O (g).
write the balanced equation here:

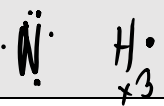
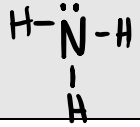
example	work	answer
3.5 g of ethane and 3.5 g of O ₂ were present initially. Find the moles of both reactants.		
Find the limiting reactant.		

0.7 Electron Structure

Part 1: Defining terms

Term	Definition	Why is this important to know to determine the structure of a compound? (ie. Lewis Structure)
Valence Electron		
Octet Rule		
Covalent Bond *Include single, double, and triple bond definition		
Ionic Bond		
Dipole/ Polar Bond		

Part 2: Drawing Simple Lewis Structures

Chemical Formula & Work if needed	Total Number of Valence Electrons	Number of Paired Electrons (unbonded)	Number of unpaired electrons (become __ bonds)	Lewis Structure (bonded electrons as lines)
Ex. NH ₃ 	8	2	6 (becomes 3 bonds)	
H ₂ O				
CH ₄				
F ₂				
CO ₂				
PCl ₃				