

AP Chemistry Summer Assignment packet

Summer 2021

Due date: September 9th

GUIDELINES FOR COMPLETING THE ASSIGNMENT

This packet was created to help you succeed in your upcoming AP Chemistry class. Many of the concepts covered in this packet were taught to you in your previous Chemistry class.

For each of the questions make sure you show all relevant work so you can receive full credit. Only HAND WRITTEN work will be accepted.

The packet is due the first day of school on September 9th. For each day the packet is late, your grade will be deducted one grade level.

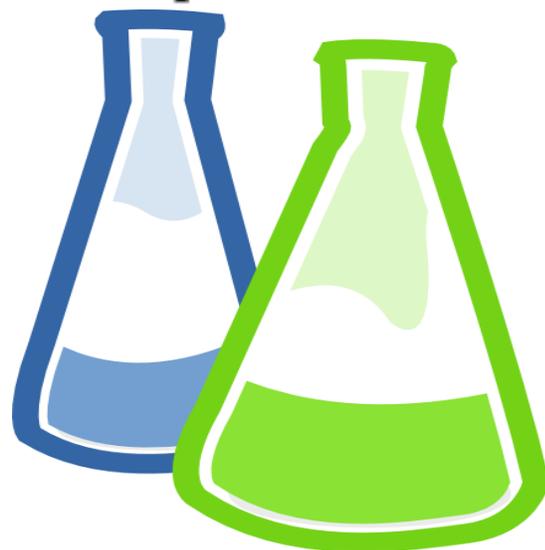
This packet will count as a 50-point test grade toward your first marking period grade.

The packet will be graded for completeness, correctness and understanding of the concepts.

You will be given a test on the materials CH1-3 within the first two weeks of school.

If you have questions, please email me during the summer. I expect the packet to be completed using the AP book and internet resources.

Have a great summer!



Chemical Foundations Chapter 1

- How many significant figures are in the following numbers?
 - 0.00150
 - 0.1205
 - 200
 - 2.00×10^3
- Complete the operation and report using the correct number of significant figures
 - $26.20 - 0.5 =$
 - $2.5 + 3.25 =$
 - $.040 \times 2.0 =$
 - $3.25 / 4 =$
 - $3.0 \times 10^{-3} \times 6 =$

Atomic , Molecules Ions CH 2 and Stoichiometry CH 3 with Periodicity CH 7

- What is an isotope?

238

Refer to the isotope of Uranium ${}_{92}\text{U}$

- How many protons and neutrons are in the nucleus of this isotope.
- How many electrons are in a single atom of Uranium
- What is the mass of this isotope of Uranium.
- Assume silicon has three major isotopes in nature. The average atomic mass of silicon is 28.09 amu. Fill in the missing information in the table.

Isotope	Mass (amu)	Abundance
${}^{28}\text{Si}$	27.89	
${}^{29}\text{Si}$		4.70%
${}^{30}\text{Si}$	29.97	3.09%

- Which color of light has the highest frequency, red or green ?
- Which color of light has the longest wavelength, green or violet?
- Hydrogen emits light with a wavelength of 410 nm, what is the frequency of this light?
- What is the electron configuration, orbital notation and noble gas notation for phosphorus? For bromine? How many unpaired electrons does phosphorus have? How many unpaired electrons does bromine have?
- What is the charge for a phosphorus ion? Why does it make this charge?
- What is the charge for an bromine ion? Why does it make this charge?

14. Which ion has the larger radius in each set? Why? Explain using coulombic force of attraction.
- Be or O
 - Cu or Br
 - F or I
 - O or As
 - Kr or K
 - Li or Ba
15. Which of the following sets are isoelectric? (Has the same electron configuration)
- Ne and F^{-1}
 - Ca^{+2} and Se^{-2}
 - N and F^{-1}
 - Ba^{+2} and I^{-1}
 - K^{+1} and Ca^{+2}
16. Which element is the most electronegative in each set?
- F or C
 - Al or Cl
 - Po or S
 - Cs or I
 - Cl or C
 - O or Se
 - Zn or K

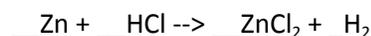
Chemical Bonding

17. What charges do Group 1 and Group 2 metals form? Explain your answer using Periodic Trends and Coulombic Forces of Attraction
18. What charges do Group 15, 16 and 17 nonmetals form? Explain your answer.
19. Draw the size and relative difference for the following ions. Explain the difference in the size using coulombic forces of attraction.
- Na^{+} Mg^{+2} Cl^{-1}
20. Which compound makes a covalent bonds?
- CO or LiF
 - ZnS or SO_2
 - BF_3 or Fe_2O_3
21. Which compound forms the bond that is the most ionic in character? Has the greatest electronegativity difference between the atoms in the bond ionic?
- Al-O or Na-O
 - K-Cl or Zn-Cl
22. Which bond is the most polar? (Apply electronegativity)
- C-F or C-O
 - P-O or P-F
 - As-F or As-S
23. Write the name for the following compounds
- $FeBr_3$
 - CuI
 - CuI_2
 - Li_2SO_4
 - PbS
 - $Sn(CO_3)_2$

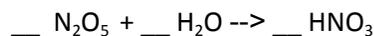
24. Write the formula for the following compounds
- chromium (III) hydroxide
 - magnesium acetate
 - chromium (IV) oxide
 - disulfur dichloride
 - nickel (II) fluoride
 - ammonia
 - aluminum nitride
 - ammonium sulfate
 - carbon tetraiodide
25. Name the following compounds. Draw the Lewis Structures for the following compounds. For each compound name the geometry and the bond angle based on the geometry.
- CO₂
 - O₃
 - NH₄⁺¹
 - CO₃⁻²
 - HCN
 - N₂

Quantitative Analysis and Stoichiometry

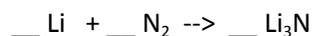
26. How many moles of sodium carbonate, Na₂CO₃, are contained in 60.0 grams of the compound?
27. How many grams of NaOH are in 0.890 moles of NaOH?
28. How many ethylene molecules are in 15.5 grams of ethylene (C₂H₂)?
29. How many formula units are in 6.30 grams of NaNO₃ ?
30. How many moles of hydrogen gas can be produced if 0.57 moles of HCl react with excess zinc according to the following equation?



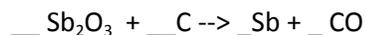
31. N₂O₅ reacts with water to produce nitric acid. If 3.25 moles of N₂O₅, how many moles of nitric acid are produced?



32. How many grams of lithium are needed to produce 42.50 grams of lithium nitride according to the following equation?



33. Suppose 35.6 grams of Antimony (III) oxide react with excess carbon according to the following equation



- What mass of antimony will be produced?
- What mass of CO will be produced?
- What mass of C is consumed?

Review CH 3 p 81-90 for q 36-41

34. A manufacturer produces a vitamin C tablet with a mass of 0.825 grams. The mass of vitamin C in the tablet is only 70 mcg (micrograms) of vitamin C. What is the percent of vitamin C in the tablet? (percent composition by mass).
35. Calculate the percent composition by mass of each element in Na_2SO_4
36. What is the empirical formula for C_4H_{10} ?
37. Is CO_2 an empirical formula? A molecular formula or both? Explain.
38. A compound contains 68.1% carbon, 13.7% hydrogen and, 18.2% oxygen by mass. (Refer to Zumdahl CH 3)
- What is the empirical formula for the compound?
 - If the compound has a molar mass of 176.34 g/mol, what is the molecular formula?
39. A compound was analyzed and found to contain 6.00 grams of carbon and 1.10 g of hydrogen. (refer to Zumdahl CH 3)
- Find the empirical formula
 - If the compound has a molar mass of 142.36 g/mol, what is the molecular formula?

Solutions CH 4

40. A scientist tries to dissolve each of the following compounds in water: NaCl , MgNO_3 , KOH , HCl , CH_3COOH , HF , $\text{C}_6\text{H}_{12}\text{O}_6$, $\text{CH}_3\text{CH}_2\text{OH}$, CCl_4 , CH_2Cl_2
- Identify the type of compound first – polar molecular non-polar molecule ionic compound, acid, base.
 - Is the compound a strong electrolyte, weak electrolyte, polar molecule OR a non-polar molecule?
 - Which compounds will not dissolve in water? Why
41. What piece of equipment do you use to make solutions in a laboratory?
42. What safety precautions do you need to use when working with strong acids?
43. What is the molarity of 0.080 grams of NaOH dissolved in 100. mL solution?
44. what is the concentration of OH^- ions in a solution of 0.250M $\text{Ca}(\text{OH})_2$?
45. How many grams are needed to make a 250. mL solution that is 0.25 M CuCl_2 ? Describe how you would prepare this solution.

46. How do you prepare a dilution of 0.300 M HCl with a volume of 500. mL from a stock that is 12.1 M?

47. How do you prepare 1.00 L of a 0.15 M HNO₃ from a 13.8M stock reagent solution?

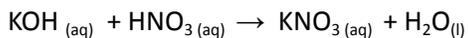
48. In a reaction 50.0 mL of 0.150 M CaCl₂ is reacted with 150. mL of 0.25 M of Na₂CO₃.



- Write a balanced equation.
- Identify the limiting reactant.
- How many grams of the solid product is produced based on the moles of the limiting reactant?

49. A 25.00 mL of HClO₄ requires 32.0 mL of 0.125 M NaOH for complete neutralization. What is the original concentration of the HClO₄ solution?

50. What volume of 0.25 M KOH will completely react with 50.0 mL of 0.150 M HNO₃ ?



- Write a balanced reaction for the equation.
- Why is it called a neutralization reaction?
- Will the solution remaining after the reaction has occurred be a neutral, acidic or basic pH? How do you know? Explain your answer.

Learn your IONS“From the Periodic Table “The ions can be organized into two groups.

1. Their place on the periodic table suggests the charge on the ion, since the neutral atom gains or loses a predictable number of electrons in order to obtain a noble gas electrons configuration.
 - a. All Group 1 Metals (alkali metals) lose one electron to form an ion with a +1 charge.
 - b. All Group 2 Metals (alkali earth metals) lose two electron to form an ion with a +2 charge.
 - c. All Group 3 Metals like Aluminum lose three electron to form an ion with a +3 charge.
 - d. All Group 17 Nonmetals (halogens) gain one electron to form a -1 charge.
 - e. All Group 16 Nonmetals gain two electrons to form an ion with a -2 charge.
 - f. All Group 15 Nonmetals gain three electrons to form an ion with a -3 charge.

Cations keep the name and anions end in “ide”Polyatomic Ions

Most of the work on learning polyatomic ions comes from a number of patterns in their names.

1. ‘ate’ anions have one more oxygen than the “ite” ion, but the same charge. Learn the ate ion and remember the trend.
 - a. Example” SO_4^{-2} is named sulfate and SO_3^{-2} is the sulfite ion.
 - b. Example NO_3^{-1} is name nitrate and NO_2^{-1} is named nitrite.
2. If you had hydrogen to a polyatomic ion, since hydrogen has a +1 charge, the charge of the polyatomic ion decreases by one. Add hydrogen to the ions name.
 - a. SO_4^{-2} is sulfate HSO_4^{-1} is named hydrogen sulfate.
 - b. A common household product – baking soda – is NaHCO_3 and named sodium hydrogen carbonate.
3. Learn the hypochlorite series (you can apply this to any halogen):
 hypochlorite->chlorite -> chlorate-> perchlorate
 $\text{HClO} \quad \rightarrow \quad \text{HClO}_2 \quad \rightarrow \quad \text{HClO}_3 \quad \rightarrow \quad \text{HClO}_4$

This series holds true, especially for the halogens,
 hypobromite-> bromite -> bromate -> perbromate
 $\text{HBrO} \quad \rightarrow \quad \text{HBrO}_2 \quad \rightarrow \quad \text{HBrO}_3 \quad \rightarrow \quad \text{HBrO}_4$

Mastery of Common Ions and Charges

A mastery of common ions, their formulas and charges is essential for AP chemistry. You are expected to know these on the first day of class – and will be tested on them. You should learn them based on the periodic table trends taught in Honors Chemistry. Many of them you already know!

Cations	Name	3rd Energy Level Cations	Name
H ⁺	Hydrogen	Ag ⁺	Silver
Li ⁺	Lithium	Zn ⁺²	Zinc
Na ⁺	Sodium	Hg ₂ ⁺²	Mercury (I)
K ⁺	Potassium	NH ₄ ⁺	Ammonium
Rb ⁺	Rubidium		
Cs ⁺	Cesium		
		Polyatomic Ions	
		Anions	
Be ⁺²	Beryllium	NO ₂ ⁻	Nitrite
Mg ⁺²	Magnesium	NO ₃ ⁻	Nitrate
Ca ⁺²	Calcium	SO ₃ ⁻²	Sulfite
Ba ⁺²	Barium	SO ₄ ⁻²	Sulfate
Sr ⁺²	Strontium	HSO ₄ ⁻	Hydrogen sulfate
Al ⁺³	Aluminum	OH ⁻	Hydroxide
Anions	Name	CN ⁻	Cyanide
H ⁻	Hydride	PO ₄ ⁻³	Phosphate
F ⁻	Fluoride	HPO ₄ ⁻²	Hydrogen phosphate
Cl ⁻	Chloride	H ₂ PO ₄ ⁻	Dihydrogen phosphate
Br ⁻	Bromide	SCN ⁻	Thiocyanate
I ⁻	Iodide	CO ₃ ⁻²	Carbonate
O ⁻²	Oxide	HCO ₃ ⁻	Hydrogen carbonate
Se ⁻²	Selenide	ClO ⁻ OR BrO ⁻ OR IO ⁻	Hypochlorite, hypobromite, hypoiodite
N ⁻³	Nitride	ClO ₂ ⁻ OR BrO ₂ ⁻ OR IO ₂ ⁻	Chlorite, bromite, iodite
P ⁻³	Phosphide	ClO ₃ ⁻ OR BrO ₃ ⁻ OR IO ₃ ⁻	Chlorate, bromate, iodate
As ⁻³	Arsenide	ClO ₄ ⁻ OR BrO ₄ ⁻ OR IO ₄ ⁻	Perchlorate. Perbromate, periodate
3rd Energy Level Or More Cations	Name	C ₂ H ₃ O ₂ ⁻ OR CH ₃ COO ⁻	Acetate
Fe ⁺³	Iron (III)	MnO ₄ ⁻	Permanganate
Fe ⁺²	Iron (II)	Cr ₂ O ₇ ⁻²	Dichromate
Cu ⁺²	Copper(II)	CrO ₄ ⁻²	Chromate
Cu ⁺	Copper(I)	C ₂ O ₄ ⁻²	Oxalate
Co ⁺³	Cobalt (III)	O ₂ ⁻²	Peroxide
Co ⁺²	Cobalt (II)	NH ₂ ⁻	Amide
Sn ⁺⁴	Tin (IV)	BO ₃ ⁻³	Borate
Sn ⁺²	Tin (II)	S ₂ O ₃ ⁻²	Thiosulfate
Pb ⁺⁴	Lead (IV)		
Pb ⁺²	Lead (II)		
Hg ⁺²	Mercury (II)		

