

A.P. Chemistry Summer Assignment for 2022-2023

Instructor: Mary Engels

Please **review** the Rules for Solubility, Oxidation Numbers (charges), Significant Figures and Ions. Also **review** how to write and name binary ionic and binary covalent compounds.

The enclosed assignment **reviews** nomenclature/formula writing, writing and balancing equations, and stoichiometry.

If you have any questions, I may be contacted at the following email address:

mhengels@fcps.edu

Please be patient for a response as I will not be checking my email on a daily basis.

Please purchase an AP Chemistry Review book (your choice of author/publisher) for next year.

Please *review* the following rules below:

Solubility Rules for Salts in Water

Soluble Compounds	Insoluble Compounds
Nitrates, hydrogen carbonates (bicarbonates), chlorates, and acetates	Hydroxides EXCEPT Group 1 metals and Ammonium. Hydroxides of Ca^{+2} , Sr^{+2} , and Ba^{+2} are slightly soluble.
Chlorides, Bromides & Iodides EXCEPT those of Pb^{+2} , Ag^{+1} , and Hg_2^{+2}	Carbonates, Phosphates, Chromates, and Sulfides EXCEPT Group 1 and Ammonium, Sulfides of Group 2 are soluble
Sulfates EXCEPT Ag^{+1} , Sr^{+2} , Ba^{+2} , Pb^{+2} , and Ca^{+2}	

Rules for Assigning Oxidation States

1. An atom in a free element is zero, 0.
2. A monatomic ion is the same as its charge.
3. Fluorine is -1 in its compounds.
4. Oxygen is usually -2 in compounds, except in peroxides in which case it is -1.
5. Hydrogen is +1 in a compound, except in metal hydrides in which case it is -1.
6. In a compound, the sum of all the oxidation numbers must total 0.

Rules for Significant Figures

1. In multiplication/division, your answer must have the same number of significant figures as the value with the least number of significant figures.
2. In addition/subtraction, your answer must have the same number of decimal places as the value with the least number of decimal places.
3. Exact numbers, which may be due to counting or equalities such as $1 \text{ mol} = 6.02 \times 10^{23} \text{ atoms}$, never limit the number of significant figures in a calculation.
4. All nonzero digits are always significant.
5. Zero's:
 - a. Leading zeros are never significant.
 - b. Sandwiched zeros, zeros between nonzero numbers are always significant.
 - c. Trailing zeros, are significant if there is a decimal and are not significant if there is no decimal.

Symbols & Charges for Ions Reference Sheet

Monatomic Ions:

<u>Cation Symbol</u>	<u>Name</u>	<u>Anion Symbol</u>	<u>Name</u>
H ⁺	hydrogen ion	H ⁻	hydride
Li ⁺	lithium ion	F ⁻	fluoride
Na ⁺	sodium ion	Cl ⁻	chloride
K ⁺	potassium ion	Br ⁻	bromide
Mg ⁺²	magnesium ion	I ⁻	iodide
Ca ⁺²	calcium ion	O ⁻²	oxide
Sr ⁺²	strontium ion	S ⁻²	sulfide
Ba ⁺²	barium ion	N ⁻³	nitride
Ag ⁺¹	silver ion	P ⁻³	phosphide
Zn ⁺²	zinc ion		
Al ⁺³	aluminum ion		

Polyatomic Ions:

<u>Formula</u>	<u>Name</u>	<u>Formula</u>	<u>Name</u>
NO ₃ ⁻	nitrate	CrO ₄ ⁻²	chromate
NO ₂ ⁻	nitrite	CrO ₇ ⁻²	dichromate
MnO ₄ ⁻	permanganate	CN ⁻	cyanide
OH ⁻	hydroxide	O ₂ ⁻²	peroxide
CO ₃ ⁻²	carbonate	SO ₃ ⁻²	sulfite
HCO ₃ ⁻¹	hydrogen carbonate	PO ₃ ⁻³	phosphite
SO ₄ ⁻²	sulfate	ClO ₄ ⁻	perchlorate
PO ₄ ⁻³	phosphate	ClO ₂ ⁻	chlorite
NH ₄ ⁺	ammonium	ClO ⁻	hypochlorite
ClO ₃ ⁻	chlorate	C ₂ O ₄ ⁻²	oxalate
C ₂ H ₃ O ₂ ⁻	acetate	S ₂ O ₃ ⁻²	thiosulfate

The following symbols and charges are for reference purposes. You are expected to know these symbols and be able to determine charges from formulas or the name.

Transition Metals:

<u>Cation Symbol</u>	<u>IUPAC Name</u>	<u>Cation Symbol</u>	<u>IUPAC Name</u>
Cu ⁺¹	Copper (I)	Hg ₂ ⁺²	Mercury (I)
Cu ⁺²	Copper (II)	Hg ⁺²	Mercury (II)
Fe ⁺²	Iron (II)	Pb ⁺²	Lead (II)
Fe ⁺³	Iron (III)	Pb ⁺⁴	Lead(IV)
Sn ⁺²	Tin (II)	Co ⁺²	Cobalt (II)
Sn ⁺⁴	Tin (IV)	Co ⁺³	Cobalt (III)
Cr ⁺²	Chromium (II)	Ni ⁺²	Nickel (II)
Cr ⁺³	Chromium (III)	Ni ⁺⁴	Nickel (IV)
Mn ⁺²	Manganese (II)	Au ⁺¹	Gold (I)
Mn ⁺³	Manganese (III)	Au ⁺³	Gold (III)

AP Chemistry Summer Assignment

Summer Assignment Calendar – Approximately 1 hour per week, completing 1 section at a time.

Week #1

Significant figures

1. Give the number of significant figures (digits) in each of the following numbers:

- a. 123 _____ b. 0.089 _____ c. 76004 _____ d. 43,000 _____
e. 1,000,000.0 _____ f. 0.004 _____ g. 5600.0 _____ h. 0.00034 _____

2. Perform the following calculations and answer with correct significant figures:

- a. $1.23 + 65 =$ _____ e. $(45.0 \times 9.0) + (89.22/75) =$ _____
b. $1.67 - 0.20 =$ _____ f. $(2.88 + 0.5)(23,000 - 0.11) =$ _____
c. $45.6 \times 8.2 =$ _____ g. $(0.8897 \times 2.15) - (0.002/0.1) =$ _____
d. $234/0.298 =$ _____ h. $(8 + 9)/(34.0 - 20.) =$ _____

Dimensional Analysis

3. Convert the following measurements to the indicated unit: (**show work using dimensional analysis & sig figs**)

- a. $0.050 \text{ cm} =$ _____ mm c. $1.9 \text{ L} =$ _____ mL
b. $1872 \text{ mg} =$ _____ kg d. $310 \text{ J} =$ _____ kJ

4. An aluminum block has a density of 2.70 g/mL. If the mass of block is 24.60 g, determine the volume of the block. (show work & sig figs)

5. A student can eat 4.0 M&M's every 1.00 seconds. If an M&M has a mass of 63 mg, determine how many kilograms of M&M's can be eaten by a class of 20 students in 3.75 hours. (show work & sig figs)

Week #2

Nomenclature – Write the IUPAC name or formula given the respective formula/name:

Formula	Name
6. P_4O_{10}	_____
7. $ZnBr_2$	_____
8. SCl_6	_____
9. CaF_2	_____
10. N_2S_3	_____
11. _____	carbon monoxide
12. _____	sodium hydroxide
13. _____	aluminum selenide
14. _____	xenon hexafluoride
15. _____	dinitrogen monoxide
16. $KClO_3$	_____
17. $Pb(CO_3)_2$	_____
18. $Ca(MnO_4)_2$	_____
19. N_2O_4	_____
20. $FeBr_3$	_____
21. _____	manganese (VII) oxide
22. _____	francium dichromate
23. _____	copper (II) phosphide
24. _____	silver nitrate
25. _____	ammonium oxalate ₄
26. $(NH_4)_2SO_4$	_____

Formula	Name
27. $\text{Ni}_3(\text{PO}_4)_2$	_____
28. $\text{Fe}(\text{ClO}_2)_3$	_____
29. $\text{Na}_2\text{S}_2\text{O}_3$	_____
30. H_3PO_4	_____
31. _____	sulfurous acid
32. _____	hydrofluoric acid
33. _____	mercury (II) nitrate
34. _____	vanadium (V) oxide
35. _____	carbon tetrachloride

Week #3

The Mole

36. Convert the following to moles: (show work using dimensional analysis, units and sig figs)

a. 12.64 g NaOH

c. 800. g CaBr_2

b. 3.011×10^{22} molecules H_2O

d. 40.0 L Ne @ STP

37. Given 0.750 moles of oxygen determine:

a. The mass in grams

b. The number of **atoms**

c. Volume @ STP

- d. The volume at 30.0°C and 95.3 kPa

Percent Composition

38. Calculate the percent composition by mass for each element in K_2CrO_4 (show work and 2 decimal places)

Weeks #4 & 5

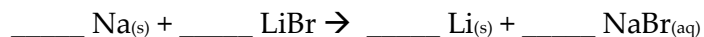
Balancing Equations

39. Write and balance the equations for the following reactions:
- Iron metal reacts with oxygen gas to form solid rust, iron (III) oxide.
 - Aqueous barium hydroxide reacts with aqueous sulfuric acid to produce a solid and water.
 - Solid potassium perchlorate is heated vigorously to produce solid potassium chloride and oxygen gas.

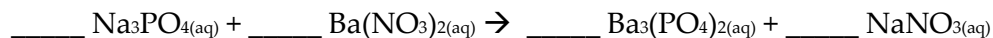
Stoichiometry

Balance the equations and solve the problems showing work, units and sig figs:

40. 30.5 g sodium metal reacts with a solution of excess lithium bromide. How many grams of lithium metal are produced?



41. A solution of 3.50 g of sodium phosphate is mixed with a solution containing 6.40 g of barium nitrate. How many grams of barium phosphate will precipitate? (**Limiting Reactant**)



42. Sodium azide, NaN_3 , decomposes into its elements. How many liters of nitrogen at STP will be produced from 10.0 g of sodium azide?



Week # 6

Electron Configuration & Periodicity

43. Write the **electron configuration** for nickel.
44. Draw the **orbital diagram** for nickel.
45. How many unpaired electrons are in Arsenic? _____
46. How many valence electrons are in mercury? _____
47. Write the electron configuration for uranium.
48. Which is more electronegative, sulfur or chlorine (circle one)? Why?
49. Which has a larger radius, potassium or bromine (circle one)? Why?

50. Which has the lower ionization energy, nitrogen or phosphorus (circle one)? Why?

51. Which is more reactive, Potassium or iron (circle one)? Why?

52. Which is more reactive, chlorine or iodine (circle one)? Why?

Week #7

Lewis Structures & VSEPR

53. For the compounds below:

- Draw the Lewis Structure
- Identify the shape
- Identify the bond angle
- Indicate if it is polar or non-polar
- Indicate the type of Intermolecular Force

a. SeCl_2

b. OF_2

c. BF_3

d. CO_2

e. NH_3

f. CCl_4

g. HCN

h. H_2CO (methanal)