AP CHEMISTRY 2018 SUMMERWORK

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Assignment Access Code:

eTEXT ACCESS: www.pearsonschool.com/access
Access CODE : SSNAST-SCOFF-STEYR-DAYAN-TAROT-FAKES

Intent of Assignment:

- ☐ Establish basic expectations of AP level chemistry in terms of student work and text.
- ☐ Reintroduce and Refine some of the basic concepts and skills learned in chemistry.
- ☐ Demonstrate student commitment and work ethic.
- ☐ Allows us to spend more class time on the more rigorous and less familiar concepts during the school year.

Assignment Due Date:

Assignments must be completed and turned in by ***August 27, 2018***

Resources:

- ☐ Chemistry, A Molecular Approach (AP Edition) 4th Edition (Nivaldo J. Tro)…**eText**
- ☐ Lab Experiments for AP Chemistry, 1st Edition (Dr. Sally Vonderbrink)…LMC
- ☐ http://socratic.org/chemistry...225 Chemistry Topics on file
- ☐ https://www.youtube.com/watch?v=6pUzPh_lCO8&list=PLllVwaZQkS2op2kDuFifhStNsS49LAxkZ
- ☐ Bozeman Science AP Chemistry
- ☐ 5 Steps To A 5 (AP Chemistry 2018)…Optional, but strongly recommended

Assignment Requirements

1. ALL calculation-based question must be supported by mathematical setup. Units must be included in work and answer. Sloppy work will result in deduction of points. I must be able to clearly understand your work.
2. Work must be completed in PENCIL only.
3. If you complete a section/segment of questions on a separate sheet of paper, You MUST include a section title.

Topic & Resource	ASSIGNMENT Task(s)
Chapter 1…Matter, Measurements & Problem-Solving **Uncertainty in Measurement & Significant Figures** ☐ **READ…Ch.1.6 – 1.7** ☐ **WATCH Video Tutorial Accuracy and Precision, Systematic Error and Random Uncertainty.** **https://www.youtube.com/watch?v=icWY7nI Crfo** ☐ **WATCH Video Tutorials @ socratic.org…** o Significant Figures • Trapped zeros count • If there is a decimal, zeros to the right of a real number count. o Scientific Notation o Accuracy, Precision, and Percent Error ☐ **REVIEW "Reporting Laboratory Data" in Lab Manual**	***A.* WORKSHEET 1…***Significant Figures, Accuracy & Precision Error and Error Analysis in Chemistry Experiments*
Chapter 2…Atoms & Elements ☐ **READ…Ch.2.3 – 2.8** ☐ **REVIEW: Fundamental Chemical Laws** http://chemwiki.ucdavis.edu/Textbook_Maps/General_Chemistry_Textbook_Maps/Map%3A_Chemistry_(Zumdahl_and_Zumdahl)/02%3A_Atoms_Molecules_and_Ions/2.02_Fundamental_Che mical_Laws	*You should be able to do average atomic mass.* *I will not assign a worksheet for this just yet.*

Chapter 3…Molecules, Compounds & Chemical Equations

- ✓ **READ Ch.3.2 – 3.11**
- ✓ **WATCH Video Tutorials @ socratic.org…**
  - The Periodic Table
  - Metals and Nonmetals
  - Metalloids
  - Ionic Compounds
  - Polyatomic Ions
  - Writing Ionic Formulas
  - Naming Ionic Compounds
  - Covalent Formulas and Nomenclature
  - The Mole
  - Percent Composition
  - Empirical and Molecular Formulas

Chapter 4…Chemical Quantities & Aqueous Reactions

- ☐ **READ 4.2 – 4.4**
- ☐ **WATCH Video Tutorials @ socratic.org…**
  - Stoichiometry
  - Mole Ratios
  - Equation Stoichiometry
  - Limiting Reagent
  - Percent Yield
  - Solutions
  - Solute
  - Solvent
  - Solution Formation
  - Solvation and Dissociation
  - Saturated and Supersaturated Solutions
  - Measuring Concentration
  - Solving Using PPM (Parts Per Million)
  - Molarity
  - Percent Concentration
  - Dilution Calculations
  - Factors Affecting Solubility
  - Solubility Graphs

B. ***Stealth Bomber Read****, naming poly atomics,*
Naming and identifying anions is critical for chemistry. You should be proficient on this and will be tested day two of school

C. **WORKSHEETS 2 &3** *Stealth bomber practice*

D. **WORKSHEET 4:** *Writing Formulas and Naming Compounds (AKA Chemical Nomenclature)*

E. **WORKSHEET 5:** *Empirical & Molecular Formula*

F. **WORKSHEET 6:** Mass conservation in chemical Reactions

G. **WORKSHEET 7**: Solutions

AP Chemistry Summer Assignment Worksheets (1-8)

WORKSHEET 1 (Significant Figures, Accuracy & Precision, Error and Error Analysis in Chemistry Experiments)

1. State the number of significant digits in each measurement

a. 0.003068 m		e. 7500 m		g. 75.00 m	
b. 4.6×10^5 km		f. 750 m		h. 75.000 m	
c. 75,000 m		g. 75 m		i. 10 cm	
d. 5.029 mm		h. 75.0 m		j. 1.00×10^{-4} cm	

2. Round the following numbers as indicated:

(A) To four figures:				
3.682417	21.860051	375.6523	45.4673	112.511
(B) To the 1/10th place:				
8.235	1.3511	5.687524	2.473	7.555
(C) To the 1/100th place:				
79.2588	41.86632	0.03062	22.494	3.4125

3. Solve the following problems and report answers with appropriate number of significant digits.

a) 6.201 cm + 7.4 cm + 0.68 cm +12.0 cm		e) 5.7621 m x 6.201 m	
b) 8.264 g - 7.8 g		f) 1.6 km + 1.62 m +1200 cm	
c) 12.00 m+15.001 kg		g) 40.002 g/ 13.000005 g	
d) 1.31 cm x 2.3 cm		h) 10.4168 m - 6.0 m	

4. Express the following numbers in their equivalent scientific notational form:

a) 123,876.3		d) 0.000238	
b) 0.000000000000211		e) 1,236,840	
c) 422000		f) 0.0000205	

5. Identify the sums, differences, products or quotients of the following:

a) $(6.3 \times 10^{-2}) - (2.1 \times 10^{-2})$		f) $(3.56 \times 10^{5})(4.21 \times 10^{6})$	
b) $8.45 \times 10^{7} / 6.74 \times 10^{3}$		g) $(5.11 \times 10^{2}) - (4.2 \times 10^{2})$	
c) $(8.41 \times 10^{4}) + (9.71 \times 10^{4})$		h) $9.7 \times 10^{8} / 8.6 \times 10^{-2}$	
d) $(2 \times 10^{7})(8 \times 10^{-9})$		i) $(4.11 \times 10^{-6}) + (7.51 \times 10^{-4})$	
e) $(8.2 \times 10^{3}) + (4.0 \times 10^{3})$		j) $1/(4.7 \times 10^{-2} / 5.7 \times 10^{-6})$	

Error and Error Analysis in Chemistry Experiments

SCENARIO A:

Suppose an experiment has been performed to determine the mass percent of sulfate ions in a sample. To show the precision of the method used, the experiment was repeated four times, with the following results:

Sample	% Sulfate	Mean	Absolute Deviation	Average Deviation	Percent Deviation
A	44.02				
B	44.11				
C	43.98				
D	44.09				

WORK/PROOF NEEDED

1. What is the experimental "mean" or "average" value? Record this value in the table above.

2. Determine the "Absolute Deviation" and record the values in the table above. You need only show a sample calculation using "SAMPLE A" data.

3. Determine the experimental "Average Deviation". Record this value in the table above.

4. Determine the "Percent Deviation" (AKA. Relative Precision) value for the experiment. record these values in the table above. You need only show a sample calculation using "SAMPLE A" data.

5. For each of the values you determined, discuss their relevance/purpose. Be concise, BUT specific in your explanation:

Mean	
Absolute Deviation	
Average Deviation	
Percent Deviation	

SCENARIO B:

An AP Chemistry student was given the very challenging task (1st day of school) to determine the density of an irregular object. The student used a digital balance to measure the object's mass, and then measured the object's volume by displacing water in a graduated cylinder, with gradations of 0.1mL. The mass of the object was determined to be 4.52g and the level of the water in the cylinder was 19.55mL and 23.55mL when the object was placed into the water.

1. Calculate the object's density.

2. Determine the uncertainty of the
   a. Mass

   b. Volume

   c. Density

3. Calculate the percent error that resulted if the theoretically accepted value (according to the handbook of Chemistry & Physics) for the sample measured is known to be 0.703 g/cm^3.

4. Comment on the error. Is the uncertainty greater or less than the percent error? Is the error random or systematic? Briefly explain.

WORKSHEET 4: **Writing Formulas and Naming Compounds**

(AKA Chemical Nomenclature)

BACKGROUND

Writing formulas and naming compounds can be confusing because there are different types of compounds that follow different rules. Additionally, some compounds (H_2O, NH_3, CH_4, etc.) simply have ***common names*** that must be memorized.

The two types of compounds we will focus on first are ***ionic compounds*** (formed from positive and negative ions) and ***binary nonmetal compounds*** (molecular compounds). Later we will add ***acids***. So… you must recognize the ***type*** of compound before you try to name it. [Note: + ion = "cation" and – ion = "anion".]

	Ionic	**Binary Nonmetal**
Formula	+ ion before – ion ex: NaCl $(NH_4)_2SO_4$ Al_2S_3	usually the less electronegative atom is first ex: CO CO_2 N_2O
Naming	Name of cation + name of anion • sodium chloride • ammonium sulfate • aluminum sulfide	Indicate the number (mono, di, tri, and kind of atoms. First element is simply name of element. Second element name ends with "ide" • carbon monoxide • carbon dioxide • dinitrogen monoxide

1. Writing Ionic Formulas

	Cl^-	NO_3^-	S^{2-}	CO_3^{2-}	N^{3-}	PO_4^{3-}	OH^-
Na^+							
NH_4^+							
Sn^{2+}							
Hg_2^{2+}							
Al^{3+}							
Sn^{4+}							

2. Naming Ionic Compounds

Cation	Anion	Formula	Name
Cu^{2+}	OH^-		
Ba^{2+}	SO_4^{2-}		
NH_4^+	$Cr_2O_7^{2-}$		
Ag^+	$C_2H_3O_2^-$		
Fe^{3+}	S^{2-}		

PREFIXES

mono	di	tri	tetra	penta	hexa	hepta	octa	nona	deca

III. Writing Formulas of Binary (containing only 2 different elements) Nonmetal Compounds

Name	Formula	Name	Formula
nitrogen trifluoride		phosphorus trichloride	
nitrogen monoxide		phosphorus pentachloride	
nitrogen dioxide		sulfur hexafluoride	
dinitrogen tetroxide		disulfur decafluoride	
dinitrogen monoxide		xenon tetrafluoride	

IV. Naming Binary Nonmetal Compounds

Name	Formula	Name	Formula
	CCl_4		HBr
	P_4O_{10}		N_2F_4
	ClF_3		XeF_3
	BCl_3		PI_3
	SF_4		SCl_2

V. Practice for Both Types of Compounds

Formula	Name
HCl	
PCl_5	
K_2S	
$NiSO_4$	
ClF_3	
OF_2	
$Al(OH)_3$	
NCl_3	
$(NH_4)_3PO_4$	

Formula	Name
	carbon dioxide
	ammonium carbonate
	sulfur dichloride
	calcium iodide
	boron trifluoride
	phosphorus triiodide
	magnesium perchlorate
	potassium permanganate
	aluminum phosphate

WORKSHEET 5: Empirical & Molecular Formula

DIRECTIONS- Use the information provided in each question to answer each follow up question on a separate sheet of paper.

1. Give the empirical formula that corresponds to each of the following molecular formulas.
   a. Sodium peroxide, NaO

   b. Terephthalic acid, $C_8H_6O_4$

   c. Phenobarbital, $C_{12}H_{12}N_2O_3$

   d. 1, 4-dichloro-2-butene, $C_4H_6Cl_2$

2. Which of the following pairs of compounds have the same **empirical** formula?
   a. Acetylene, C_2H_2, and benzene, C_6H_6

   b. Ethane, C_2H_6, and benzene, C_6H_6

   c. Nitrogen dioxide, NO_2 , and dinitrogen tetroxide, N_2O_4

3. D. Diphenyl ether, $C_{12}H_8O$, and phenol, C_6H_5OHIn an experiment, a 2.514-g sample of calcium was heated in a stream of pure oxygen, and was found to increase in mass by 1.004 g. Calculate the **empirical formula** of calcium oxide.

4. A compound has the following percentages by mass: barium, 58.8%; sulfur, 13.74%; oxygen, 27.43%. Determine the **empirical formula** of the compound.

5. If a 1.271-g sample of aluminum metal is heated in a chlorine gas atmosphere, the mass of aluminum chloride produced is 6.280 g. Calculate the **empirical formula** of the aluminum chloride.

6. If cobalt metal is mixed with excess sulfur and heated strongly, a sulfide is produced that contains 55.06% cobalt by mass. Calculate the **empirical formula** of the sulfide.

7. A compound has the following percentage composition by mass: copper, 33.88%; nitrogen, 14.94%; oxygen 51.18%. Determine the **empirical formula** of the compound.

8. A compound with the empirical formula CH_2 was found to have a molar mass of approximately 84 g. What is the **molecular formula** of the compound?

9. A compound with the empirical formula CH_4O was found in a subsequent experiment to have a molar mass of approximately 192 g. What is the **molecular formula** of the compound?

10. A compound consists of 65.45% C, 5.492% H, and 29.06% O on a mass basis and has a molar mass of approximately 110 g/mol. Determine the **molecular formula** of the compound.

WORKSHEET 6: Mass Conservation in Chemical Reactions

DIRECTIONS- Use the information provided in each scenario to answer each follow up question.

Scenario A:

Burning coal and oil in a power plant produces pollutants such as sulfur dioxide, SO_2. The sulfur-containing compound can be removed from other waste gases, however, by the following reaction:

____ $SO_2(g)$ +_____$CaCO_3(s)$ +_____$O_2(g)$ →_____$CaSO_4(s)$ +_____$CO_2(g)$

[MM (g/mol) _____ _____ _____ → _____ _____ **]**

1. Fill-in the missing coefficients.
2. Fill-in the missing molar masses (MM)
3. Provide a molecular (particle-level) interpretation of the reaction:

4. Provide a molar interpretation of the reaction:

5. During a lab experiment, 155g of sulfur dioxide was reacted.
   a. What is the mass percent of sulfur dioxide?

   b. How many moles of sulfur dioxide makes up that amount?

   c. At STP, how much volume (in mL) would that amount of SO_2 gas take up?

   d. How many moles of calcium carbonate ($CaCO_3$) would have to react as well? What would that quantity of moles be in grams?

e. How many moles of O_2 would also have to react as well? How many mL of space would that quantity of O_2 gas occupy at STP?

f. How many moles and grams of calcium sulfate ($CaSO_4$), and how many moles, liters, and grams of carbon dioxide were made?

Calculation	
Moles	
Volume (liters)	
Mass (grams)	

Scenario B:

The reaction of methane and water is one way to prepare hydrogen:

_____ $CH_4(g)$ + _____ $H_2O(g)$ → _____ $CO(g)$ + _____ $H_2(g)$

[Molar masses: _____g/mol 18.02g/mol → _____ _____]

6. Assume that you used 995 g of CH_4 and 2510 g of water.
   a. Justify and then identify the "Limiting" reagent/reactant. Determine how many moles of the limiting reagent/reactant will react.

   b. Identify the "Excess" reagent/reactant. Determine how many moles of the "Excess" reacts with the "Limiting".

c. Calculate the maximum volume of H_2 that can be yielded? What is that quantity in moles and grams?

d. How many moles and grams of the "Excess" reagent/reactant remains unreacted?

SCENARIO C

Diborane, B_2H_6, is a valuable compound in the synthesis of new organic compounds. One of several ways this born compound can be made is by the reaction

$2\ NaBH_4(s) + I_2(s) \rightarrow B_2H_6(g) + 2\ NaI(s) + H_2(g)$

[Molar masses: 37.84 253.8 27.67 149.9 2.02]

Suppose you use 1.203 g of $NaBH_4$ with an excess of iodine and obtain 0.295 g of B_2H_6. What is the percent yield of B_2H_6?

WORKSHEET 7: Solutions

DIRECTIONS - *Use the information provided in each question to answer each follow up question.*

Section A: Solubility & Solubility Curves

1. What is the difference between a solute and solvent?

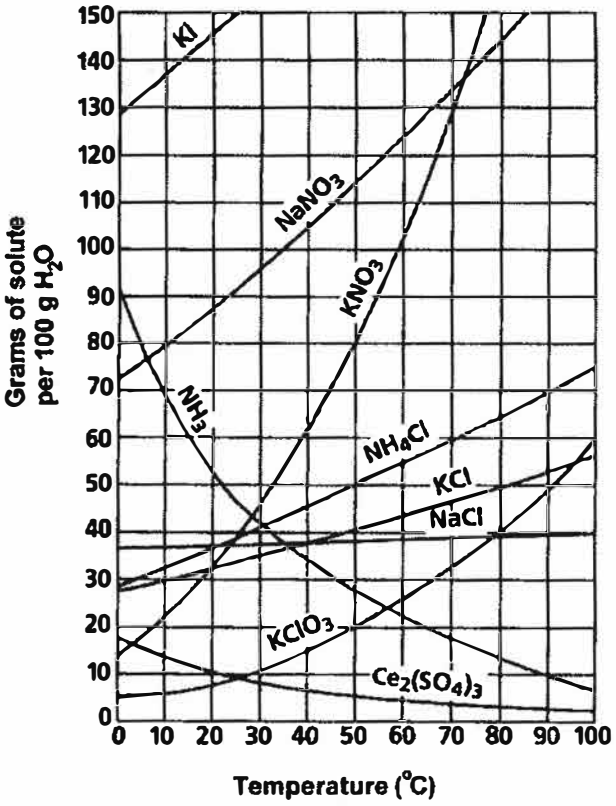
2. Define the terms miscible and immiscible.

3. How is "solubility" defined?

4. What are the differences between a saturated solution, unsaturated solution and a supersaturated solution?

5. How can you tell that a solution is saturated?

6. Use the solubility curve below to answer questions a - e. Be sure to note the units on the axes of the graph.



a. In general, how does temperature affect solubility?

b. Which compound is least soluble at 10°C?

c. How many grams of KCl can be dissolved in 100g of water at 80°C?

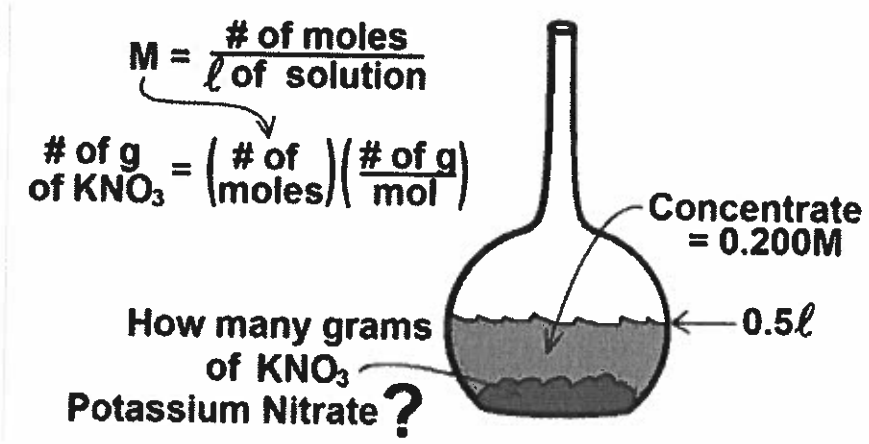
d. How many grams of NaCl can be dissolved in 50g of water at 90°C?

e. At 60°C, 72 g of NH4Cl are dissolved in 100g of Water. This solution is considered (check the box that applies):

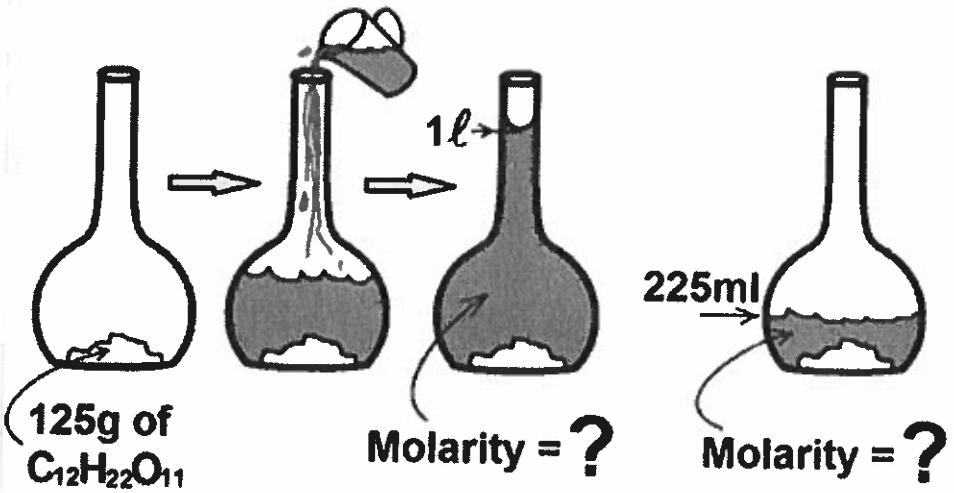
- ❑ Saturated
- ❑ Unsaturated
- ❑ Supersaturated
- ❑ Saturated with some left undissolved

Section B: Solution Concentration

1.



2.



3. What volume of 0.88 M potassium chromate (K_2CrO_4) contains 0.32 moles of potassium ions?

4. Concentrated ammonia contains 26 g per 100 mL of solution. What is the molarity of this solution?

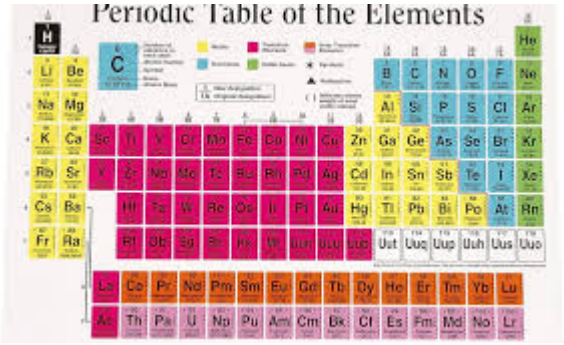
5. What volume of 0.275M $Ba(OH)_2$ must be used to have 8.65 g of barium hydroxide?

6. What is the concentration of all ions present in a solution that is 0.250 M $AlCl_3$?

7. What mass of solute would be needed to prepare 125 mL of 0.188 M sodium phosphate (Na_3PO_4)?

Stealth Bomber for Naming the Polyatomic ions

When it comes to naming ions, it can be very challenging. The metals form cations, and nonmetals form anions. Metals are typical easy because you don't have to change the name just add a roman numeral for the metals containing d-block electrons because of its ability to lose different number of electrons to gain stability. Nonmetals can be easy if you know how to use the periodic table and a tool called the stealth bomber.



Can you find the hidden bomber in the periodic table?

The stealth bomber is made up of two wings and a square body.

Now let's place it on your periodic table, because most of the polyatomic are elements with oxygen and are found often in the food you eat, we can cross off fluorine and oxygen since the polyatomic ions are full of oxygen. Therefore, we don't use them in the bomber.

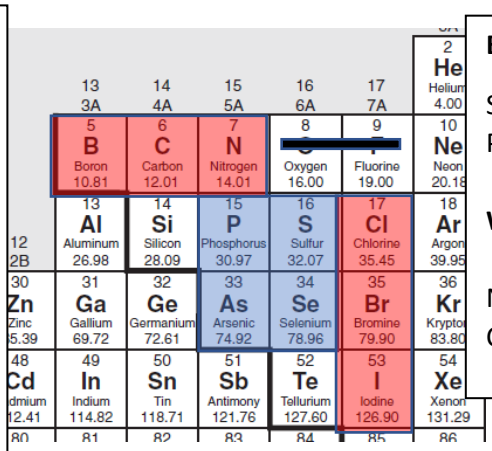
The body of the bomber include Phosphorus, sulfur, arsenic, and selenium. Put a box around these elements. There are two wings on the bomber. The top wing consists of boron, carbon, and nitrogen. Place a rectangle around this wing. The second wing runs top to bottom and starts with chlorine and moves down to iodine. Draw a rectangle on this wing as well.

How many elements would it take to make the body full?

How many for each wing to make them full?

This is how many oxygens are needed to make the polyatomic ion full. The ending used for the polyatomic that is **full** of oxygen is **-ate**, because after you just ate you get full.

-ATE = full of Oxygen



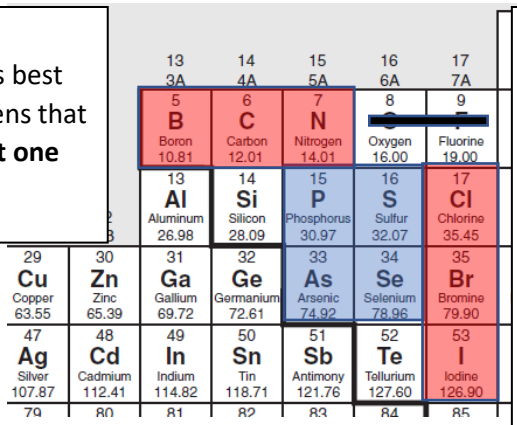
Body: ate= full of oxygen (4)

Sulfate (SO_4)
Phosphate (PO_4)

Wing: ate= full of oxygen (3)

Nitrate (NO_3)
Chlorate (ClO_3)

The ending **-ite means not full** polyatomic ion with oxygen. Its best to start with the number oxygens that would make it full and **subtract one** for the -ite ending.



Body: -ate= full of oxygen (4)

-ite= one less than full (3)

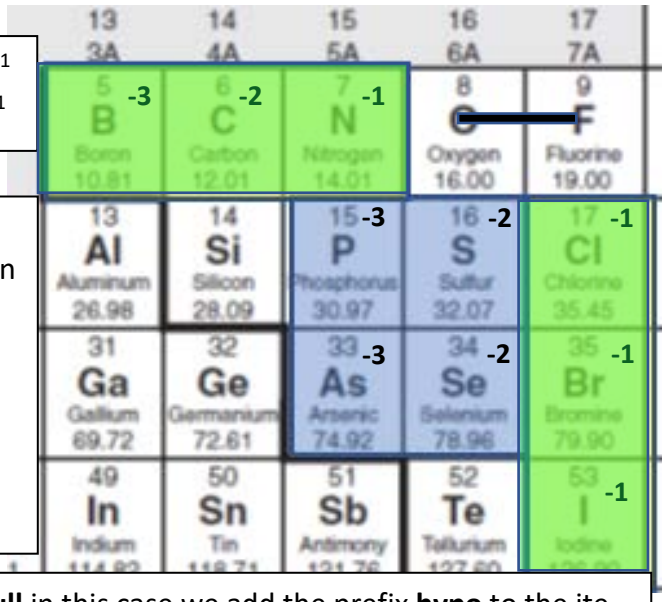
Sulfate (SO_4) Sulf**ite** (SO_3)
Phosphate (PO_4) Phosph**ite** (PO_3)

Wing: -ate= full of oxygen (3)
-ite= one less than full (2)

Nitrate (NO_3) Nitrite (NO_2)
Chlorate (ClO_3) Chlorite (ClO_2)

Now that you know the difference between the ending ide, ate and ite. We can use the periodic table top get the charges as well. Count right to left to get the charges (start on right go 1-, 2-, and 3-)
The charge is the same whether its an -ate or an -ite. Remember the only difference between the -ate and -ite endings are the number of oxygens.

Phosphate $(PO_4)^{-3}$ Sulfate $(SO_4)^{-2}$ Chlorate $(ClO_3)^{-1}$
Phosphite $(PO_3)^{-3}$ Sulfite $(SO_3)^{-2}$ Chlorite $(ClO_2)^{-1}$



There is more to the bomber besides ate and ite, sometimes polyatomic ions can be more than full in this case we add the prefix per to the ate.

Per-_____-ate means more than full

perphosphate $(PO_5)^{-3}$ phosphate $(PO_4)^{-3}$

per= one more oxygen than full (-ate)

Sometimes polyatomic ions can be **two less than full** in this case we add the prefix **hypo** to the ite.

Hypo-_____-ite means two less than full

perphosphate $(PO_5)^{-3}$ phosphate $(PO_4)^{-3}$

hypo= take away another oxygen the not full (-ite)

-ide- monoatomic ions->use valence to get charge
("A" groups)

-ate ↘
↗ Polyatomic ions (containing oxygen)→stealth bomber→ Body (4) or Wing (3) → Full of oxygen / Less than full oxygen
-ite

Name:_____

WORKSHEET 2

Name the ion or give the formula with charge

Formula	Name
SO_4^{-2}	
Cl^{-1}	
CO_3^{-2}	
PO_3^{-3}	
BrO_2^{-1}	
SO_3^{-2}	
BO_3^{-3}	
N^{-3}	
	sulfide
	sulfate
	carbonate
	carbide
	hypochlorite
	phosphate
	nitrite
	iodite

Name:_____

WORKSHEET 3

Complete the following table by ether naming the compound or giving the formula

Formula	Name
BrO_3^{-1}	
Cl^{-1}	
CO_2^{-2}	
SO_2^{-2}	
BO_2^{-3}	
C_{-4}	
SO_4^{-2}	
NO^{-1}	
	nitride
	sulfite
	nitrate
	perchlorate
	hypoborite
	phosphate
	chlorite
	carbonate