AP Chemistry Summer Prep

Hello, everyone! I am excited that you have chosen to take AP Chemistry next year. This course will challenge you, help you grow as a student, and provide many opportunities for meaningful learning throughout the year. Before we begin in August, I would like to share the foundational concepts and skills that you are expected to already understand prior to entering the course.

If you are a planner like I am and want to buy materials over summer, you will need a 1-inch binder with 8-tab dividers and a graphing calculator for this course.

I expect you to have a strong understanding of the following material before the start of the course in August:

- Memorization of common polyatomic ions, the seven diatomic elements, strong acids and bases, and the names and symbols of the elements in the first four periods of the periodic table.
- The ability to correctly write and name formulas for ionic compounds, covalent compounds, and acids.
- A solid foundation in stoichiometry, including the use of Avogadro's number, molar mass, and mole ratios in chemical calculations.
- Application of significant figure rules.

There will be a quiz the first week of school in August. You can expect the following:

- Given an element's symbol or chemical formula, provide the element or formula's name and vice versa.
- Given a polyatomic ion, provide its chemical formula (including charge) and vice versa.
- Be able to name ionic and covalent formulas, including acids.
- Complete basic stoichiometry problems and answer questions using appropriate significant figures.

This packet is completely optional but does provide a solid foundation of the skills you will need going into this course.

Please check @BiesChem on YouTube for the "AP Chemistry Summer Prep" video teaching these principles in case you need a refresher. It will be uploaded during the month of June.

See you in August!

♥ Mrs. Bies

Element Name	Element Symbol
Hydrogen*	H
Helium	He
Lithium	Li
Beryllium	Be
Boron	B
Carbon	C
Nitrogen*	N
Oxygen*	O
Fluorine*	F
Neon	Ne
Sodium	Na
Magnesium	Mg
Aluminum	Al
Silicon	Si
Phosphorus	P
Sulfur	S
Chlorine*	Cl
Argon	Ar
Potassium	K
Calcium	Ca
Scandium	Sc
Titanium	Ti
Vanadium	V
Chromium	Cr
Manganese	Mn
Iron	Fe
Cobalt	Co
Nickel	Ni
Copper	Cu
Zinc	Zn
Gallium	Ga
Germanium	Ge
Arsenic	As
Selenium	Se
Bromine*	Br
Krypton	Kr

*** Diatomic elements**

Polyatomic Ion Name	Polyatomic Ion Formula
Ammonium	NH_4^+
Acetate	$C_2H_3O_2^-$
Hydroxide	OH^-
Nitrate	NO_3^-
Nitrite	NO_2^-
Sulfate	SO_4^{2-}
Sulfite	SO_3^{2-}
Hydrogen sulfate	HSO_4^-
Carbonate	CO_3^{2-}
Hydrogen carbonate	HCO_3^-
Phosphate	PO_4^{3-}
Hydrogen phosphate	HPO_4^{2-}
Chromate	CrO_4^{2-}
Dichromate	$Cr_2O_7^{2-}$
Permanganate	MnO_4^-
Cyanide	CN^-
Hypochlorite	ClO^-
Chlorite	ClO_2^-
Chlorate	ClO_3^-
Perchlorate	ClO_4^-
Oxalate	$C_2O_4^{2-}$
Peroxide	O_2^{2-}
Thiocyanate	SCN^-

<u>Significant Figure Rules</u>

1. Leading zeros are NEVER significant
2. Trailing zeros are only significant if a decimal is present.
3. If multiplying or dividing, your answer should result with the least number of significant figures from numbers used to calculate.
   2.45 x 3.876 = 9.50
4. If adding or subtracting, your answer should result with the fewest decimal places from numbers used to calculate.
   678.3 + 3.87 = 682.2
5. If you are doing math with both addition/subtraction and multiplication/division, follow rule #3.

Naming Ionic Compounds: Ionic compounds are made up of a metal cation (named first) and a non-metal anion (named second, change ending to -ide for monatomic ions). Their charges cancel out to zero. When naming ionic compounds, we never indicate the ratio of component elements in the name - that is for covalent compounds only. For polyatomic ions, the names are never changed.

Ex: NaCl → Sodium chloride, Na_2O → Sodium oxide, NH_4OH → Ammonium hydroxide

Naming Covalent Molecules: Consists of only non-metals. For naming of these molecules, we use prefixes to indicate the number of atoms of each element. However, we do not put mono- for the first element in the formula. It is implied. Ending of the molecule name is changed to -ide.

Ex: SF_6 → Sulfur hexfluoride, CO_2 → Carbon dioxide, N_2O_4 → Dinitrogen tetroxide

Acids are a type of covalent compound that release hydrogen ions when dissolved in water. Binary acids are composed of hydrogen and one other element, while oxyacids contain hydrogen, oxygen, and another element. Translating binary acids from formula to name will end up in the format *hydro*[root of anion]*ic acid.* Translating oxyacids from formula to name involves dropping the word hydrogen completely, replacing the anion's suffix, and adding acid. The oxyacid suffix replacements are *-ate* becomes *-ic* and *-ite* becomes *-ous.*

Ex: HF → Hydrofluoric acid, H_2SO_4 → Sulfuric acid, H_2CO_3 → Carbonic acid

In the Table below, please write the name of the substance next to the formula given.

Formula	Name
HClO	
SO_3	
NaBr	
NiP_2	
$(NH_4)_3PO_4$	
HF	
Li_2S	
SF_6	
Cu_2S	
$KMnO_4$	

In the Table below, please write the formula of the substance next to the name given.

Name	Formula
Calcium sulfide	
Silver iodate	
Carbon monoxide	
Tin (IV) cyanide	
Nitric acid	
Potassium carbonate	
Hydrosulfuric acid	
Diboron tetrabromide	
Zinc borate	
Copper (II) phosphate	

Stoichiometry

1. How many grams are in a 2.8 mol sample of iron?

2. Given the equation: $2\ K + Cl_2 \rightarrow 2\ KCl$
   How many grams of KCl are produced from 1.00 g of Cl_2 and excess K?

3. What is the percent composition by mass of each element in $Ca_3(PO_4)_2$?

4. The following reaction occurs:
   $NaCl + AgNO_3 \rightarrow AgCl + NaNO_3$
   a. How many grams of AgCl result from the reaction of 1.30 g of NaCl and 3.5 g of $AgNO_3$?

   b. Limiting reactant: _____ Excess reactant: _____
   c. How much of the excess reactant is left over?

   d. If the reaction actually yielded 2.7 g of AgCl, what is the percent yield and the percent error for the reaction?

5. What is the empirical formula of zircon if its percent composition by mass is 34.91% O, 15.32% Si, and 49.76% Zr?

6. How many atoms of aluminum are in a 63 g sample of Al_2O_3?

Answers

Given	Explanation	Answer
$HClO$	H in the beginning, think acid! ClO^- is hypochlorite. -ite changes to -ous. Add the word acid.	Hypochlorous acid
SO_3	Two non-metals…. Covalent bonding! Think prefixes. Never start with mono, so drop it.	Sulfur trioxide
NaBr	Metal and a non-metal, think ionic! State the element name of the metal, change the ending of the non-metal	Sodium bromide
NiP_2	Metal and a non-metal, ionic! Nickel is a transition metal. Two P ions is a -6 charge. So Ni must be +6.	Nickel (VI) phosphide
$(NH_4)_3PO_4$	Two charged polyatomic ions (one positive one negative), ionic! Just state the names of the ions.	Ammonium phosphate
HF	H in the beginning, think acid! Not a polyatomic. Use the framework hydro[root word]ic acid.	Hydrofluoric acid
Li_2S	Metal and a non-metal, think ionic! State the element name of the metal, change the ending of the non-metal	Lithium sulfide
SF_6	Two non-metals…. Covalent bonding! Think prefixes. Never start with mono, so drop it.	Sulfur hexafluoride
Cu_2S	Metal and a non-metal, ionic! Copper is a transition metal. P ion is a -2 charge. There are two Cu ions. So each must be +1.	Copper (I) sulfide
$KMnO_4$	Metal and a negative polyatomic ion, ionic! State first element name. State polyatomic ion name.	Potassium permanganate
Calcium sulfide	Metal and non-metal. Get charges and balance to zero.	
Silver iodate		
Carbon monoxide		
Tin (IV) cyanide		
Nitric acid		
Potassium carbonate		
Hydrosulfuric acid		
Diboron tetrabromide		
Zinc borate		
Copper (II) phosphate		