

June 3, 2024

Future AP Chemistry Students,

AP Chemistry is intended to be a college-level course. We will be following the guidelines set forth by The College Board AP Program for Chemistry and will be using a college-level textbook. The material will be covered quickly (much is review of or expanding on Chemistry I topics) and you will be expected to efficiently use the resources provided for you. A lot of preparation for labs, quizzes, and tests will be expected **outside of the classroom**. At the end of the year, it is expected that all students will be prepared to be successful on the AP Chemistry test. A score of 3, 4, or 5 out of 5 will allow you to get credit at most colleges, making your schedule more flexible and saving you (or your parents) money.

This leads me to why I am writing this now. You need to realize that this class will be challenging for every one of you. The pace of the class and the depth of the material will require you to put in more time and effort than many of you are accustomed. You will be expected to be an active participant in class (share your talents!). You have the ability to affect every one of your classmates (positively or negatively) each day. It is frustrating for me and visibly frustrating for the dedicated students in the class when AP students do not put forth their best effort. It is a privilege to be able to take a college-level course while still in high school, and I hope that you all will treat it as such. It is unfair to your classmates for you to not put forth your best effort.

Over the summer, you have three assignments that need to be completed:

- 1) Send me an e-mail telling me three things: (1) What were some of your favorite things about your first year in chemistry, (2) What were some of your least favorite things about your first year in chemistry, and (3) What are your expectations for AP Chemistry? Your e-mail should be a couple of paragraphs – I just want to get an idea before school starts. **You are sending it to your teacher; it should be edited!**
- 2) Commit to memory the basic facts I've included that you MUST know to have success in AP Chemistry. If you need to, make flash cards and look over them often during your summer vacation.
- 3) Complete the assignment that focuses on key areas in which you will be expected to be fluent. If you have any questions, feel free to send me an e-mail. I may not respond immediately, but I will respond.

Please note that the summer work is not expected to be a comprehensive review of everything covered in first-year chemistry. The summer homework reflects the material that it will be expected that you know as soon as you enter class. These topics, from the problems and the list of basic facts, will be assumed to be understood when we begin class next fall. It is expected that you will be able to competently perform all of the tasks that appear on the summer assignment. If you need assistance on any of the topics, you should send an e-mail message to me or get in touch with one of your future classmates.

For an idea of the types of questions we will be preparing for, you can access recent copies of the short answer portion of the AP Exam online.

<https://apcentral.collegeboard.org/courses/ap-chemistry/exam>

Thank you,

Mr. Porter  
AP Chemistry Teacher  
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# THINGS TO KNOW!

- You should be familiar with the periodic table.
  - Have a general idea where elements are
  - Know which elements are diatomic ( $\text{H}_2$ ,  $\text{N}_2$ ,  $\text{O}_2$ ,  $\text{F}_2$ ,  $\text{Cl}_2$ ,  $\text{Br}_2$ ,  $\text{I}_2$ )
  - Know chemical symbols for commonly used elements
- You should be familiar with common ions
  - Know charges for metal and nonmetal ions
  - Know common polyatomic ions and their charges (sheet attached)
- Know how to do unit conversions (like converting grams to moles)
- You should be familiar with proper significant figures
- You should be familiar with scientific notation
- Know the gas laws:  $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$        $PV=nRT$   
 $R = .0821 \frac{\text{L}\cdot\text{atm}}{\text{mol}\cdot\text{K}}$   
 $R = 62.4 \frac{\text{L}\cdot\text{mmHg}}{\text{mol}\cdot\text{K}}$   
 $R = 8.31 \frac{\text{L}\cdot\text{kPa}}{\text{mol}\cdot\text{K}}$
- You should be familiar with concepts of atomic structure
  - Protons, neutrons, electrons
  - Atomic number, mass number, atomic mass
  - Electron configuration (like  $1s^22s^22p^5$ )
- You should be able to name and write chemical formulas for compounds
  - Ionic compounds – no prefixes needed
  - Molecular compounds – use numerical prefixes (mono, di, tri, etc.)
- You should be able to balance chemical equations
- You should be able to predict the products of elementary reactions (synthesis, decomposition, single replacement, double replacement, combustion)
- You should know ALL of the solubility rules (sheet attached)
- You should be able to write net-ionic equations for elementary reactions.
- You should be able to use stoichiometry, and a balanced chemical equation, to determine the amount (moles, grams, liters, molecules) of reactants or products needed in a chemical reaction.

## POLYATOMIC IONS

Name	Formula and Charge	Name	Formula and Charge
Acetate	$C_2H_3O_2^-$	Hypochlorite	$ClO^-$
Ammonium	$NH_4^+$	Mercury (I)	$Hg_2^{2+}$
Carbonate	$CO_3^{2-}$	Nitrate	$NO_3^-$
Chlorate	$ClO_3^-$	Nitrite	$NO_2^-$
Chlorite	$ClO_2^-$	Oxalate	$C_2O_4^{2-}$
Chromate	$CrO_4^{2-}$	Perchlorate	$ClO_4^-$
Cyanide	$CN^-$	Peroxide	$O_2^{2-}$
Dichromate	$Cr_2O_7^{2-}$	Permanganate	$MnO_4^-$
Dihydrogen phosphate	$H_2PO_4^-$	Phosphate	$PO_4^{3-}$
Hydrogen carbonate or bicarbonate	$HCO_3^-$	Phosphite	$PO_3^{3-}$
Hydrogen phosphate	$HPO_4^{2-}$	Silicate	$SiO_3^{2-}$
Hydrogen sulfate or bisulfate	$HSO_4^-$	Sulfate	$SO_4^{2-}$
Hydrogen sulfite or bisulfite	$HSO_3^-$	Sulfite	$SO_3^{2-}$
Hydroxide	$OH^-$		

## SOLUBILITY RULES FOR IONIC COMPOUNDS

General Rule	Exceptions
1. Ionic compounds with a group 1 metal ( $Li^+$ , $Na^+$ , $K^+$ , $Rb^+$ , $Cs^+$ ) or ammonium ( $NH_4^+$ ) are soluble.	None
2. Ionic compounds with nitrate ( $NO_3^-$ ), chlorate ( $ClO_3^-$ ) or acetate ( $C_2H_3O_2^-$ ) are soluble.	None
3. Most ionic compounds with a chloride, bromide, or iodide ( $Cl^-$ , $Br^-$ , $I^-$ ) are soluble.	silver, lead, mercury
4. Most ionic compounds with sulfate ( $SO_4^{2-}$ ) are soluble.	silver, lead, mercury, calcium, barium, strontium
5. Most ionic compounds with carbonate ( $CO_3^{2-}$ ), phosphate ( $PO_4^{3-}$ ), or sulfide ( $S^{2-}$ ) are insoluble.	Rule 1
6. Most hydroxides ( $OH^-$ ) are insoluble.	Rule 1, calcium, barium, strontium

## AP CHEMISTRY SUMMER WORK

This work is due on the first full day of class. If you have any questions, do not hesitate to send me an e-mail (bporter@abs.misd.net). I will be traveling during the summer, so I can't guarantee an immediate response. However, I will respond as soon as I can. Feel free to work together, but realize that you are each responsible for knowing how to do these problems. Do your work on lined paper and staple this assignment to the back. For ALL problems that involve calculations, show your work completely! **Nothing written on this sheet will be graded.**

**Section 1** – Write the correct chemical formulas for the following ionic compounds

1. Magnesium fluoride
2. Lithium nitride
3. Potassium chloride
4. Iron (III) sulfide
5. Calcium oxide
6. Sodium nitrate
7. Aluminum bromide
8. Lithium sulfate
9. Magnesium phosphate
10. Lead (II) acetate

**Section 2** – Write the correct chemical formulas for the following molecular compounds

1. Nitrogen dioxide
2. Carbon tetrachloride
3. Diphosphorus pentoxide
4. Chlorine trifluoride
5. Dinitrogen tetrafluoride
6. Dichlorine monoxide
7. Xenon hexafluoride
8. Sulfur dioxide

**Section 3** – Name the following ionic compounds

1.  $\text{Na}_2\text{SO}_4$
2.  $\text{CuCl}$
3.  $\text{Na}_2\text{O}$
4.  $\text{NH}_4\text{HCO}_3$
5.  $\text{CaO}$
6.  $\text{Cr}_2\text{O}_3$
7.  $\text{Mn}_2\text{O}_3$
8.  $\text{Cu}(\text{NO}_3)_2$

**Section 4** – Name the following molecular compounds

1.  $\text{N}_2\text{O}$
2.  $\text{AsCl}_3$
3.  $\text{N}_2\text{F}_2$
4.  $\text{N}_2\text{O}_5$
5.  $\text{P}_4\text{O}_{10}$
6.  $\text{Cl}_2\text{O}_7$
7.  $\text{NCl}_3$
8.  $\text{As}_4\text{O}_6$

**Section 5** – Tell how many moles of each element are present (use proper significant figures)

1. 46.0 g of Na
2. 385.7 g of Pb
3. 148.2 g of Hg
4. 27.3 g of Br
5. 85.4 g of Mg
6. .358 g of Cu

**Section 6** – Determine the molar masses of the following compounds

1.  $\text{Na}_2\text{SO}_4$
2.  $\text{CuCl}$
3.  $\text{Na}_2\text{O}$
4.  $\text{NH}_4\text{HCO}_3$
5.  $\text{CaO}$
6.  $\text{Cr}_2\text{O}_3$
7.  $\text{Mn}_2\text{O}_3$
8.  $\text{Cu}(\text{NO}_3)_2$

**Section 7** – Write the complete electron configuration and the noble gas configuration for the following elements.

Ex. Ca:  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$  and  $[\text{Ar}]4s^2$

1. Phosphorus
2. Aluminum
3. Fluorine
4. Nickel
5. Potassium
6. Silver

**Section 8** – Draw Lewis structures for the following compounds and ions.

1.  $\text{CCl}_4$
2.  $\text{C}_2\text{H}_6$
3.  $\text{NBr}_3$
4.  $\text{NH}_4^+$
5.  $\text{CO}_2$
6.  $\text{PCl}_6^-$

**Section 9** – Use the combined gas law to calculate the missing value.

1. The pressure of a gas is 1.5 atm when the volume is 50.0 mL. What is the pressure if the volume of the gas container is increased to 75.0 mL?
2. The volume of a gas at 273 K is 1.25 L. What will be the volume of the gas if the temperature is increased to 300. K?
3. A certain gas in a 2.00 L container has a pressure of .80 atm when the temperature is 298 K. What will be the pressure if the gas is forced into a 1.50 L container and the temperature is reduced to 273 K?

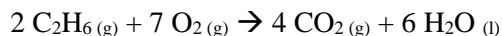
**Section 10** – Use the ideal gas law to answer the following.

1. What is the pressure of .650 moles of a gas in a 1.25 L container at 298 K?
2. What volume would 2.50 moles of a gas at 1.35 atm and 325 K occupy?

**Section 11** – Predict the products of these elementary reactions and write balanced chemical equations.

1. (Synthesis) Magnesium metal is burned in oxygen gas.
2. (Single replacement) Chlorine gas is added to a solution of potassium bromide.
3. (Double replacement) Solutions of lead (II) nitrate and sodium chloride are mixed.
4. (Single replacement) Aluminum metal is added to a solution of copper (II) chloride.

**Section 12** – Stoichiometry; answer the following questions about the balanced equation below:



1. How many moles of carbon dioxide are formed when two moles of ethane are burned?
2. How many grams of water are formed when 25.1 g of ethane are burned?
3. What volume (at STP) of oxygen gas is needed to completely react with 4.25 moles of ethane?

**Section 13** – Limiting reactants; answer the following questions about the equation below.



1. Balance the equation.
2. Give the correct name for each of the substances in the reaction.
3. Given 124 g of  $\text{Fe}_2\text{O}_3 (\text{s})$  and 32.5 g of  $\text{CO} (\text{g})$ ,
  - a) determine the limiting reactant for the above reaction.
  - b) determine what mass of  $\text{Fe} (\text{s})$  will be formed in the reaction described.