AP Chemistry Summer Assignment

Welcome to AP Chemistry! This is a rigorous, but exciting, course that moves at a very fast pace in order to cover the same material as a year-long collegiate level chemistry course. The CollegeBoard's suggested prerequisite for AP Chemistry is a year's worth of general chemistry. Therefore, this summer assignment is meant to focus on refreshing skills from Chem CP.

I have made a Google Classroom called "AP Chemistry Summer 2020." Join code is: vbxwof5
You may join it if you would like to, but it's not required. I have tentative plans to host a couple optional help sessions via Zoom over summer break for stoichiometry help and will post information there regarding dates, times and links. These are completely optional! You are under no obligation to join the Google Classroom or attend the help sessions.

You will need to know the concepts from the beginning chapters of our textbook. We use the text Chemistry: A Molecular Approach by Nivaldo Tro. Chapters 1-3 are primarily a review of selected topics from CP Chemistry and are essential background knowledge to the advanced topics that will be covered in AP Chemistry. Very little time will be spent in class reviewing this material, so it is your responsibility to ensure that you have mastered these introductory topics.

TASK 1 - Read Chapters 2 and 3 in the textbook and outline the chapters in your notes (You do not need to take notes on chapter 1, but it is provided as optional reading). Practice active reading skills. Reread if necessary. Take note of key equations, figures, tables and vocabulary. Copying important example problems may be a helpful technique.

TASK 2 - Complete the self-assessment exercises at the end of each chapter (Ch. 2 is on pages 74-75; Ch. 3 page 127). Attempt each problem honestly. Record your *initial* answers in your notes. The correct answers are provided, but this is a tool that will help you understand whether you have understood the main concepts or not. Remember, your goal is to master this material. Do not cheat yourself of this learning opportunity.

TASK 3 - Complete the attached stoichiometry practice problem set. You must show your work for each calculation and supportive written explanations when they are asked for. Start practicing your AP test skills now by showing your work and writing as neatly as possible. (Remember AP graders need to be able to read your exam responses in order to score it.)

If you need help, consider these resources for independent study, or think about attending one of my help sessions:

Bozeman Science Stoichiometry video: https://www.youtube.com/watch?v=LQq203gyftA

Khan Academy: https://www.khanacademy.org/science/chemistry/chemical-reactions-stoichiome#stoichiometry-ideal

Tyler DeWitt "Moles" playlist: https://www.youtube.com/playlist?list=PL3hPm0ZdYhyxMcbHkcUgRlM4-w4gAgfRA

All 3 tasks are to be completed over summer before the first day of school. All written work will be collected during the 1st class session of the second week of school. Thank you for your hard work!

Stoichiometry Practice Problem Set

PART A: Moles

1. Fill in the following table

Amount	Number of moles	Number of atoms	Number of atoms in scientific notation
12 g carbon, C	1 mol	602,000,000,000,000,000,000,000 atoms	6.02×10^{23} atoms
24 g carbon, C			
40 g calcium, Ca			
20 g calcium, Ca			

PART B: Molar Mass

2. Use your periodic table to fill in the following.

Chemical formula	Molar mass (g/mol)
$Ne(g)$	
$Ca(s)$	
$CO_2(g)$	
$CaCO_3(s)$	
$CH_4O(l)$	
$C_2H_6O(l)$	
$Fe_2O_3(s)$	

3. How many moles are in 80 g of Calcium?

4. How many moles are in 88 grams of CO_2 ?

5. How many grams are in 3.5 moles of Ne?

6. How many grams are in 2.25 moles of Ca?

7. According to the table, calculate how many moles of pain reliever can be found in a standard dose of each kind of pain reliever.

Pain reliever	Molecular formula	Molar mass	Adult dose	Moles in a standard dose
ibuprofen	$C_{13}H_{18}O_2$	206.3 g/mol	400 mg	
acetaminophen	$C_8H_9NO_2$	151.2 g/mol	500 mg	
acetylsalicylic acid (aspirin)	$C_9H_8O_4$	180.2 g/mol	325 mg	

8. Why might a 200 mg tablet of aspirin tablet not have the same effect as a 200 mg tablet of ibuprofen?

PART C: Solution Concentration/Molarity

9. Define molarity:

10. Fill in the following table:

Moles of Solute	Liters of Solution	Molarity of Solution
1 mol	1 L	1M
	1 L	2M
	1 L	0.5M
2 moles		1 M
	3 L	1 M
3.6 moles		1 M
1 mol	0.5 L	
1 mol		3 M
1 mol	2 L	

11. Calculate the molarity for each of these salt solutions. Then list the solution in order of increasing molarity.
    a. 4.0 mol NaCl per 8.0 L
    b. 6.0 mol NaCl per 6.0 L
    c. 1.0 mol NaCl per 10 L

12. Which solution is the most concentrated?
    a. 0.10 mol of NaCl in 1.0 L
    b. 0.50 mol of NaCl in 1.0 L
    c. 0.10 mol of NaCl in 0.50 L
    d. 0.10 mol of NaCl in 0.2 L

13. There are many different units of concentration besides molarity that you may encounter in many areas of life.
    a. Infant Acetaminophen (brand name Tylenol) comes in liquid form with the concentration of 80 mg/0.8 mL. If you give an infant a 1.6 mL dose, how many mg is this?

    b. Children's Acetaminophen comes in concentration of 160mg/5mL, how many mg would be in 5mL dose?

    c. Which solution is more concentrated?

    d. If you only had infant acetaminophen, how many mL would you need to give an adult who needs a 500mg dose?

14. How can you increase the molarity of a solution? (Pick a letter) Then explain <u>why</u> that will increase the molarity of the solution.
    a. Add solute
    b. Add solvent
    c. Pour out some solution
    d. All of the above

PART D: Reaction stoichiometry

15. Balance the following equations:

$\_\_\_ Fe_2O_3 + \_\_\_ H_2O \rightarrow \_\_\_ Fe(OH)_3$

$\_\_\_ C_2H_6 + \_\_\_ O_2 \rightarrow \_\_\_ CO_2 + \_\_\_ H_2O$

$\_\_\_ NaBr + \_\_\_ O_2 \rightarrow \_\_\_ NaBrO_3$

$\_\_\_ C_2H_6O + \_\_\_ O_2 \rightarrow \_\_\_ CO_2 + \_\_\_ H_2O$

$\_\_\_ Al(OH)_3 + \_\_\_ H_2SO_4 \rightarrow \_\_\_ Al_2(SO_4)_3 + \_\_\_ H_2O$

16. The balanced equation for the reaction of sodium carbonate and hydrochloric acid is given:

$$Na_2CO_3\ (aq) + 2HCl\ (aq) \rightarrow CO_2\ (g) + H_2O\ (l) + 2NaCl\ (aq)$$

Assume that you begin with 30.0g of sodium carbonate.

a. How many grams of NaCl can be formed?

b. How many liters of CO_2 are produced? (assume STP conditions)

c. How many molecules of H_2O are produced?

d. What is the minimum mass of HCl needed in order for all of the sodium carbonate to be fully consumed?

17. Carbon monoxide reacts with nitrogen monoxide to form carbon dioxide and nitrogen according to the following balanced equation.

$$2NO\ (g) + 2CO\ (g) \rightarrow 2CO_2\ (g) + N_2\ (g)$$

a. Suppose you start with 3.6 g of NO and perform the reaction at STP conditions. How many liters of N_2 are produced from this reaction?

18. The density of nitric oxide, a highly corrosive mineral acid, is 1.51 g/cm3. It is involved in the following balanced reaction.

$$4NO\ (l) + O_2\ (g) + 2H_2O\ (l) \rightarrow 4HNO_2\ (aq)$$

Suppose you start with 13.3 L of liquid nitric oxide.

a. How many grams of NO do you have?

b. How many moles of HNO_2 can be produced if all of the NO reacts?

19. Decomposition of hydrogen peroxide results in water and oxygen gas.

$$H_2O_2\ (l) \rightarrow 2H_2O\ (l) + O_2\ (g)$$

How many grams of hydrogen peroxide are needed to produce 1.20×10^{24} molecules of oxygen gas?

20. Water vapor reacts with potassium superoxide to form oxygen and potassium hydroxide.

$$4KO_2\ (s) + 2H_2O\ (l) \rightarrow 3O_2\ (g) + 4KOH\ (s)$$

How many grams of potassium superoxide were consumed in the reaction if 43.0 L of oxygen gas is produced from this reaction? (Assume STP conditions)