

AP CHEMISTRY
SUMMER ASSIGNMENT 2023

Welcome to AP Chemistry! I'm looking forward to a great year together, and cannot wait for you to experience the excitement of understanding the world on a more fundamental level. Below is a list of major topics that we covered in Honors Chemistry. The attached exercises will allow you to review these topics. It will be especially helpful for those who are advancing from CP Chemistry who may not have covered all these topics. **Your work on these assignments will be collected on the first day of the school year, and it will be graded for a combination of completion and accuracy. If you do not know how to solve a problem, please make an effort to learn.** However, the purpose of this assignment is to allow you (and I) to identify areas of strengths and weaknesses as you enter the course. Therefore, don't be overly alarmed if you struggle with some of these problems – we'll be reviewing more challenging content.

REVIEW TOPICS

Metric System and conversions	Entropy
Significant figures	Gibbs free energy
Basic information on the Periodic Table of Elements	Basic Atomic Theory –
Nomenclature of binary and ternary compounds	Subatomic particles
The mole & Avogadro's Number	Structure of the atom
Stoichiometry of elements and compounds	Electron configuration
Stoichiometry of reactions	Valance electrons
Involving all three states of matter	Understanding bonding
Limiting reagents	Describing and determining types of chemical bonds (ionic, covalent and metallic)
% yield	
Gas Laws	Generating and using Lewis Dot Structures
The Ideal Gas Law (and derived Gas Laws)	Determining molecular geometry and polarity
Properties of a gas	
Kinetic Theory of Matter	
Thermodynamics	
Enthalpy and energy diagrams	
Endothermic reactions	
Exothermic reactions	
Hess's Law	
Calorimetry	

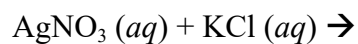
- Determine the molar mass of chromium(VI) phosphate.
- What is the percent by mass of oxygen in calcium sulfite?
- Element X is known to have an average atomic mass of 175.689 g and two stable isotopes having isotopic masses of 178.92319 g and 173.8759 g, respectively. What is the percentage of each of the stable isotopes in a sample of Element X?
- Calculate the molarity of a solution composed of 35.8 g of iron (III) phosphate dissolved into 135 mL of water.

8. A compound is known to have the following percent composition by mass: 71.65% Cl, 24.27% C and 4.07% H. a) Calculate the compound's empirical formula. b) It is further determined that the compound has a molar mass of 98.96 g/mol. Determine the compound's molecular formula.

Week of July 25th - Stoichiometry of Chemical Reactions

9. Write the balanced equation represents the reaction between phosphoric acid and calcium hydroxide.

10. Consider the reaction below. Assume that excess potassium chloride (KCl) is added to a 345 mL solution of 0.2 M silver nitrate (AgNO₃), and that a white precipitate forms. (a) Identify the formula of the white precipitate (b) How many grams of this white precipitate can be isolated? (c) State the formula of anything that is still dissolved in the water after the reaction.



11. The compound $\text{Cu}(\text{NH}_3)_4\text{SO}_4$ is made the following reaction of copper (II)sulfate and ammonia:
$$\text{CuSO}_4 (\text{aq}) + 4 \text{NH}_3 (\text{aq}) \rightarrow \text{Cu}(\text{NH}_3)_4\text{SO}_4$$
- a) If 10.0 g of CuSO_4 are reacted, determine the theoretical yield of $\text{Cu}(\text{NH}_3)_4\text{SO}_4$. b) The reaction is run to completion and you obtain 12.6 g of $\text{Cu}(\text{NH}_3)_4\text{SO}_4$. What is the % yield of the reaction?

12. 50.0 g of sodium (Na) react with 50.0 g of chlorine gas (Cl_2) to form table salt (NaCl). a) Which reactant is the limiting reactant? b) What mass of NaCl will be formed, assuming 100% yield? c) How much of the non-limiting reactant will remain?

13. If 30.2 mL of 2 M Li_2CO_3 is mixed with 42.5 mL of 1.7 M CaCl_2 , a) How many grams of CaCO_3 will precipitate? b) What is the final concentration of the excess reagent? c) Write the net ionic equation for this reaction.

14. In a lab designed to create MgCl_2 from a reaction between HCl (aq) and Mg (s), you start with a 5.259 g sample of Mg . The sample is placed in the acid and allowed to react until all of the magnesium is consumed. The beaker is then heated until only the MgCl_2 remains.

a. What are the products of this reaction?

b. How much MgCl_2 would you expect to produce?

15. You run the above experiment twice with the same equipment and collect the data below, determine the percent error for each trial AND give a possible explanation for the calculated percent error for each.

	Trial 1	Trial 2
Mass of empty, dry beaker	77.50 g	77.50 g
Mass of dry beaker w/ dry MgCl_2	99.23 g	96.87 g

Week of August 1st – Gas Laws

16. A 2.57 L sample of O₂ has a measured pressure of 920 torr and temperature of 30°C. a) How many moles of gas are present in the sample? b) Would you expect a 2.57 L sample of H₂ that has the same pressure and temperature to contain a greater, lesser, or equivalent number of moles. Explain.

17. If a sample of H₂ gas has a pressure of 1.2 atm in a 3.4 L rigid container, what will be the pressure of that same sample of gas if it is moved to a 1.4 L rigid container?

18. A solution of 0.75 M HCl is reacted with excess Na₂CO₃ to generate CO₂ as follows:



As a result, a volume of 37.1 mL CO₂ is collected over water at 25°C and 755 mmHg. Given that the partial pressure of water vapor at these conditions is 23.8 mmHg, what volume of HCl was reacted?

19. If you raise the temperature of a gas in a rigid container, what happens to the pressure of the gas? Explain what is happening on the particulate level. Be sure to explain what pressure is.

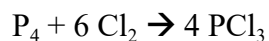
Week of August 8thth - Thermodynamics

20. Nitrogen monoxide reacts with oxygen to form nitrogen dioxide



a) Draw an energy diagram for this reaction, and label the change in enthalpy for the reaction? b) Is this reaction endothermic or exothermic? How do you know? c) What is the enthalpy change when 1.25 g of NO are converted completely to NO₂?

21. PCl₃ can be formed by the combination of its constituent elements as shown:



Given the following experimental data, calculate the enthalpy change that occurs when a mole of PCl₃ is formed.



22. A 21.8 g sample of zinc is heated to 98.8°C and dropped into an insulated beaker containing 46.0 g of water at a temperature of 25.0°C. After reaching thermal equilibrium, the temperature of beaker and contents is 27.1°C. Determine the specific heat capacity of zinc based on this data.

Week of August 15th – Atomic Structure

23. An electron falls from the $n = 4$ to the $n = 2$ energy level and emits a photon of wavelength 570 nm.
 a) What frequency does this correspond to? b) how much energy does the photon possess?

24. Fill in the missing blocks on the following table:

period	group	symbol	# of p ⁺	Common charge or oxidation #	Atomic mass	Valance e ⁻ configuration
						3s ² 3p ⁶
7				-3		
		P				
6	2					

25. Write the full electron configuration for each of the following:
a. Se:

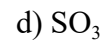
b. Fe:

26. Write the condensed (Noble gas) electronic configuration for each of the following:
a. Pb:

b. Co:

Week of August 22nd - Bonding

27. Draw the Lewis Dot structure for the following:



28. Using their Lewis dot structures, explain why H_2O and BeCl_2 have different molecular geometries.

29. For the 6 molecules/ions discussed in the previous two problems, a) identify the molecular shape and state whether the molecule is polar.