

2023-2024 AP Chemistry Summer Assignment

Mr. Weinert

Adapted from Mr. Haller

This summer assignment will help to freshen your existing chemistry skills. Having a solid foundation entering the course will make for a much smoother road to the AP Test. **This assignment will be collected the first day of class.** So make sure you have it fully completed. I have included links to review videos for many of the topics, but you may need to find additional resources to help you complete the packet.

Part A – Significant Figures

Suggested video help/review: Significant Figures - A Fast Review! from The organic Chemistry Tutor

<https://www.youtube.com/watch?v=l2yuDvwYq5g>

Rules for Counting Significant Figures

- 1.) Nonzero integers: always count as significant figures
- 2.) Zeros: There are three classes of zeros
 - a.) Leading zeros are zeros that precede all the nonzero digits. These do not count as significant figures.
 - i.) In the number 0.0025, the three zeros simply indicate the position of the decimal point. The number has only two significant figures
 - b.) Captive zeros are zeros between nonzero digits. These always count as significant figures.
 - i.) The number 1.008 has 4 significant figures
 - c.) Trailing zeros are zeros at the right end of the number. They are only significant if the number contains a decimal point.
 - i.) The number 100 has only one significant figure
 - ii.) 1.00×10^2 has three significant figures
 - iii.) 100. (notice the decimal point) has three significant figures
- 3.) Exact Numbers: Many times calculations involve numbers that were not obtained using measuring devices but were determined by counting (10 experiments, 3 apples, 8 molecules). These are exact numbers. These have infinite significant figures and cannot limit the number of sig. figs. used in calculations

Rules for Significant Figures in Mathematical Operations

- 1.) For multiplication and division, the number of significant figures in the result is the same as the number in the least precise measurement used in the calculation
 - a.) $4.56 \times 1.4 = 6.38$
 - b.) 1.4 has 2 sig figs, so it is limiting to the answer

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- c.) The correct answer would be 6.4
- 2.) For addition or subtraction, the result has the same number of decimal places as the least precise measurement used in the calculation.
- a.) $12.11 + 18.0 + 1.013 = 31.123$
 - b.) 18.0 is the limiting term to one decimal place
 - c.) The correct answer would be 31.1

Rules for Rounding

- 1.) In a series of calculations, carry the extra digits through to the final result, then round
- 2.) If the digit to be removed
- a.) a. is less than 5, the preceding digit stays the same.
 - i.) 1.33 rounds to 1.3
 - b.) b. is equal to or greater than 5, the preceding digit is increased by 1
 - i.) 1.36 is rounded to 1.4

Give the significant figures for each of the following results

- a) A student's extraction procedure on tea yields 0.0105 g of caffeine
- b) A chemist records a mass of 0.050080 g in an analysis
- c) In an experiment, a span of time is determined to be 8.050×10^{-3} seconds
- d) A book contains more than 1000 pages
- e) A mile is about 5300 ft
- f) A liter is equivalent to 1.059 qt.
- g) The population of the United States is approaching 3.1×10^2 million
- h) A kilogram is 1000 g
- i) The Boeing 747 cruises at around 600 mi/hr

How many significant figures are there in each of the following values?

- a) 6.07×10^{-15}
- b) 0.003840
- c) 17.00
- d) 8×10^8
- e) 463.8052
- f) 300
- g) 301
- h) 300.

Write the answers to the following equations with the appropriate number of significant figures

- a) $1.05 \times 10^{-3} / 6.135$
- b) $21 - 13.8$
- c) The gas constant R is equal to Pressure * Volume/Temperature ($R = PV/T$). In an experiment, P was found to be 2.560, T was 275.15, and V was 8.8. What is R?
- d) $212.2 + 26.7 + 402.09$
- e) $1.0028 + 0.221 + 0.10337$
- f) $52.331 + 26.01 - 0.9981$
- g) $2.01 \times 10^2 + 3.014 \times 10^3$
- h) $7.255 - 6.8350$

Part B – Common Polyatomic Ions

It will benefit you greatly to have these polyatomic ions memorized or start working towards memorizing them. I would start by making flashcards/quizlet.

Describe what a polyatomic ion is

Below is a list of some of the most common polyatomic ions. Determine the correct formula and charge for these polyatomic ions

Ammonium

Phosphate

Acetate

Cyanide

Hydroxide

Permanganate

Nitrate

Hypochlorite

Nitrite

Chlorite

Carbonate

Chlorate

Sulfate

Dichroma

Sulfite

Part C – General Atomic Structure

Suggested video/review: Basic Atomic Structure: A Look Inside the Atom by Tyler DeWitt

<https://www.youtube.com/watch?v=h6LPAwAmnCQ&list=PL3hPm0ZdYhywb0pyaNIsXFzIOB3FESr0y&index=1&t=143s>

Fill out the following table describing parts of the 3 subatomic particles that make atoms

	Charge	Mass of Particle (amu)	Location in the Atom
Protons			
Neutrons			
Electrons			

For each of the following isotopes, write the number of protons, neutrons, and electrons.

Suggested video/review: What are Isotopes? by Tyler DeWitt

<https://www.youtube.com/watch?v=EboWeWmh5Pg>

	Carbon-12	Carbon-16
# of protons		
# of neutrons		
# of electrons		

	Chromium-58	Chromium-63
# of protons		
# of neutrons		

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# of electrons		
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	Nitrogen-15	Nitrogen-20
# of protons		
# of neutrons		
# of electrons		

Based on the rules from above, correctly fill out the chart below

Element	Symbol	Atomic Number	Mass Number	Protons	Neutrons	Electrons
Carbon		6	14			
	O	8			10	
Potassium				19	20	
		19	41			
	$^{197}_{79}\text{Au}$					
Tin	Sn	50			68	
Zinc			64	30		
			66			30
			68	30		
Cobalt	Co	27			32	

Part D – Bonding Basics and Naming Compounds

General bonding overview: Atomic Hook-Ups - Types of Chemical Bonds: Crash Course Chemistry #22 <https://www.youtube.com/watch?v=QXT4OVM4vXI>

I - Ionic Bonding

Cations vs Anions:

Suggested Video/review: What's an Ion? By Tyler DeWitt
<https://www.youtube.com/watch?v=WWe3k2723IM>

Describe what a cation is and why they form? What groups of elements form cations?

Describe what an anion is and why they form? What groups of elements form anions?

Describe what happens with the charges of transition metals

Determine the charge that the following atoms would form when they become ions

Mg	I
S	K
F	N
Li	P
Al	N

Forming the Ionic Bond

Ionic bonds occur between _____ and _____

Explain how ionic bonds form.

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Given the list of the following two atoms, correctly bond them together and give the correct final molecular formula

Na and Cl

Ca and Cl

Mg and O

Fe²⁺ and O

Li and S

Naming Ionic Compounds

Suggested Video/review: Naming Ionic Compounds by Professor Dave Explains

<https://www.youtube.com/watch?v=mKo72RnN37E>

What are the rules for naming and ionic compound? Be sure to include what you need to do with transition metals and polyatomic ions

Give the correct name the following ionic compounds

NaF

Ca(OH)₂

MgI₂

AgNO₃

Na₃N

Give the correct formula from the following ionic compound name

Silver bromide

Iron (III) sulfide

Lithium iodide

Copper (II) sulfate

Potassium oxide

II - Covalent Bonding

Covalent Bonding

Describe how a covalent bond forms? (How do the electrons move or flow between atoms)

Forming the Covalent Bond

Suggested Lewis Dot Structure video: Lewis Diagrams Made Easy: How to Draw Lewis Dot Structures by Ketzbook <https://www.youtube.com/watch?v=cIuXl7o6mAw>

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Draw the correct Lewis Dot Structures for the bond between the following two atoms

F and Cl

C and Cl

N and H

O and H

N and N

Naming Covalent Compounds

Suggested Video/review: Naming Covalent Molecular Compounds by Tyler DeWitt

<https://www.youtube.com/watch?v=DejkrR4pvRw>

What are the rules for naming a covalent compound?

Provide the correct formula of the following covalent compounds

disulfur tetrafluoride

nitrogen tribromide

carbon trioxide

dinitrogen heptachloride

nitrogen pentoxide

Provide the correct name for the following covalent compounds

SeF₆

CH₄

Si₂Br₆

B₂Si

SCl₄

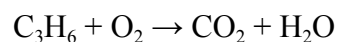
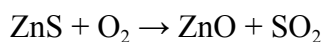
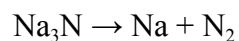
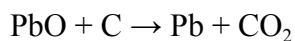
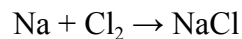
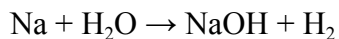
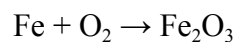
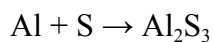
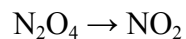
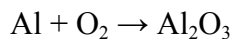
Part E – Stoichiometry and the Mole

Suggested Video/review: Stoichiometry - Chemistry for Massive Creatures: Crash Course

Chemistry #6 <https://www.youtube.com/watch?v=UL1jmJaUkaQ>

Correctly balance the following equations

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What is the unit of the mole?

Using the following reaction equations, balance the equation and then complete the correct stoichiometric calculations



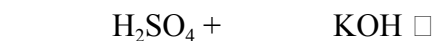
- 1.) 3.80 moles of oxygen (O_2) are used up in the reaction. How many moles of water are produced?
- 2.) How many grams of oxygen does it take to produce 96.0 liters of carbon dioxide?
- 3.) How many molecules of carbon dioxide are produced with using 5.80 grams of acetylene (C_2H_2)?
- 4.) How many grams of oxygen are required to burn 13.50 grams of acetylene?



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- 1.) 8.50 moles of carbon are used up in the reaction. How many moles of carbon dioxide are produced?
- 2.) How many grams of Fe_2O_3 does it take to produce 9.60×10^{23} atoms of carbon dioxide?
- 3.) How many grams of carbon dioxide are produced with using 95.6 grams of Fe_2O_3 ?
- 4.) How many liters of CO_2 are produced from 15.65 grams of Fe_2O_3 ?

Predict the products of the reaction with sulfuric acid and potassium hydroxide. Then answer the following stoichiometric questions:



- 1.) 4.8 moles of potassium hydroxide are used up in the reaction. How many moles of potassium sulfate are produced?
- 2.) How many grams of H_2SO_4 does it take to produce 6.48×10^{23} atoms of water?
- 3.) How many grams of potassium sulfate are produced with using 125.8 grams of potassium hydroxide?
- 4.) How many liters of H_2O (HOH) are produced from 44.7 grams of potassium hydroxide?