

AP Chemistry
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AP Chemistry Summer Assignment

Welcome to AP Chemistry! This course covers a lot of challenging concepts at a fast pace. We will be getting started right away and will not spend much time reviewing concepts you already know. This assignment is meant to be a review. If this assignment is very challenging for you and you do not feel like you have learned a majority of the concepts, then this course may not be for you. I am assuming that you have learned these skills and feel confident solving these types of problems. We will spend the first few weeks of the year going into some of the assigned chapters in more depth, so if you have some questions while you are doing the summer assignment, you will have a chance to ask. Your textbook is a great resource to utilize when you have a question about a concept. Looking forward to a wonderful year!

Textbook

Chemistry (AP Edition), 9th or 10th Edition
Steven S. Zumdahl; Susan A. Zumdahl
ISBN-10: 1-133-61110-9 & 1-305-95773-3
ISBN-13: 978-1-133-61110-3 & 978-1-305-95773-2

Make sure you get the AP Edition!

Objectives

1. To review basic concepts you learned when you took Honors Chemistry
2. To practice math skills which you will need for AP Chemistry
3. To hit the ground running when we return in the fall

Assignment Details

1. The **AP Chemistry Summer Assignment Worksheet** has two parts:
 - Includes a *math* assignment - 22 questions
 - Includes a *chemistry* assignment - 57 questions
2. Please print this document and show all work in the spaces provided. If you find you need extra space to show your work, you may staple additional sheets of paper to the back of this worksheet.
3. Feel free to reference the textbook or other external resources, but make sure that you understand the work that you are doing.
4. The summer assignment worksheet will be collected on the first day of school.
5. **DO NOT** leave all of this to the last minute - this will take a while to complete
6. Feel free to email me if you have any questions! I may take a few days to answer during the summertime.

Math Assignment

Supply the answers in the blanks. **No calculators please!** The multiple choice section of the AP exam does not allow calculators and so you need to practice doing mental math without one.

1. $1.62 \times 10^6 + 1.9 \times 10^5 =$ _____

2. $1.62 \times 10^6 - 1.9 \times 10^5 =$ _____

3. $3.72 \times 10^{-8} + 0.211 \times 10^{-7} =$ _____

4. $3.72 \times 10^{-8} - 0.211 \times 10^{-7} =$ _____

5. $(2.3 \times 10^4)(3.1 \times 10^4) =$ _____

6. square root of $9.0 \times 10^{-8} =$ _____

7. cube root of $8.0 \times 10^{-9} =$ _____

8. $\frac{(2.6 \times 10^{-8})}{(0.52 \times 10^{-9})} =$ _____

9. $x =$ _____ if $10^x = 2$ and $\log(2) = 0.30$

10. $x =$ _____ if $\frac{x^2}{0.10} = 4.0 \times 10^{-9}$

11. $x =$ _____ if $xy = 16$ and $y^2 = 225$

12. $\frac{(2.4 \times 10^{-8})(0.25 \times 10^{-2})}{(1.5 \times 10^{-4})} =$ _____

13. $\log(1.0 \times 10^4) =$ _____

14. $\log(1.0 \times 10^{-4})$ _____

15. $\log(2.3 \times 10^{-5}) =$ _____
16. approximate value of $x =$ _____ if $(x + 0.1)(x) = 2.0 \times 10^{-8}$
17. $x =$ _____ if $x + y = 3$ and $x - y = 9$
18. $(0.001)(0.001) =$ _____
19. $\frac{3.42}{342} =$ _____
20. If a megabuck is one million dollars and a kilobuck is one thousand dollars, how many kilobucks is 342 dollars?
21. A ten cm candle is being burned at both ends. One end burns at the rate of one cm per hour; the other end burns at one-half cm per hour. How far from the center of the candle will the burning ends meet?
22. A wooden cube three cm on edge is placed inside a cube box that is six cm on edge. How much free space is in the box?

Measurements and Calculations

1. Provide the SI units commonly used to express the following:
- | | |
|-----------|----------------|
| a. length | d. time |
| b. volume | e. energy |
| c. mass | f. temperature |

2. Convert the following temperatures to Kelvin:
 - a. 113°C, the melting point of sulfur

 - b. 37°C, the normal body temperature

3. Convert the following temperature to degrees Celsius:
 - a. 77 K, the boiling point of liquid nitrogen

 - b. 601 K, the melting point of lead

4. What is the number of significant figures in each of the following measurements?
 - a. 4867 mi
 - b. 56 mL
 - c. 60,104 ton
 - d. 2900 g
 - e. 40.2 g/cm³
 - f. 0.500 atm

5. Carry out the following calculations as if they were calculations of experimental results; express each answer in the correct units with the correct number of significant figures.
 - a. 5.6792 m + 0.6 m + 4.33 m

 - b. 3.70 g – 2.9133 g

 - c. 4.51 cm x 3.6666 cm

6. Carry out the following conversions (you must use conversion factors):
- 22.6 m to dm
 - 25.4 mg to kg
 - 556 mL to L
 - 10.6 kg/m^3 to g/cm^3
7. Bromine is a reddish-brown liquid. Calculate the density of bromine (in g/mL) if 586 g of the substance occupies 188 mL.
8. The average speed of helium at 25°C is 1255 m/s. Convert this speed to miles per hour (mph) using conversion factors.
9. If a space shuttle can travel 17,000 miles per hour, how far (in meters) does it travel in 5 sec?
10. A 353 mL bottle of water costs \$1.29. A gallon of tap water costs 0.525 ¢ (where \$1 = 100 ¢). How much bottled water (in L) can you buy with \$2520? How much tap water (in L) can you buy with \$2.52?

Properties of Matter

11. Do the following statements describe chemical or physical properties?

- a. Oxygen gas supports combustion.
- b. Fertilizers help to increase agricultural production.
- c. Water boils below 100°C on top of a mountain.
- d. Lead is denser than aluminum.
- e. Uranium is a radioactive element.

12. Does each of the following describe a physical change or a chemical change?

- a. The helium gas inside a balloon tends to leak out after a few hours.
- b. Frozen orange juice is reconstituted by adding water to it.
- c. The growth of plants depends on the sun's energy in a process called photosynthesis.
- d. A spoonful of table salt dissolves in a bowl of soup.

13. Give the names of the elements represented by the following chemical symbols:

- | | | |
|-------|-------|-------|
| a. Li | e. As | i. Mg |
| b. F | f. Zn | j. U |
| c. P | g. Cl | k. Al |
| d. Cu | h. Pt | l. Si |

14. Give the chemical symbols for the following elements:

- | | |
|--------------|--------------|
| a. potassium | f. plutonium |
| b. tin | g. sulfur |
| c. chromium | h. argon |
| d. boron | i. mercury |
| e. barium | j. krypton |

15. Classify each of the following substances as an element or compound:

- | | |
|-------------|----------|
| a. hydrogen | c. gold |
| b. water | d. sugar |

16. Classify each of the following as an element, compound, homogeneous mixture, or heterogeneous mixture:

- | | |
|---------------------------------|--------------------|
| a. seawater | e. milk shake |
| b. helium gas | f. air in a bottle |
| c. sodium chloride (table salt) | g. concrete |
| d. a bottle of soft drink | h. argon gas |

Molecules and Ions

17. Describe where metals are located in the periodic table. What type of charge (positive or negative) do metals form when ionized?

18. Describe where nonmetals are located in the periodic table. What type of charge (positive or negative) do nonmetals form when ionized?

19. Elements whose name ends with -ium are usually metals. Sodium is one example. Identify a nonmetal whose name ends with -ium.

20. Write the formula of the ion typically formed from each of the following:

- | | | | |
|-------|------|-------|-------|
| a. Li | c. I | e. Al | g. Ag |
| b. S | d. N | f. Cs | h. Mg |

21. Name the following compounds:

- a. KClO
- b. HNO_2
- c. KMnO_4
- d. CsClO_3
- e. FeO
- f. Fe_2O_3
- g. TiCl_4
- h. NaH
- i. Li_3N
- j. $\text{Cu}(\text{OH})$

22. Write the formulas for the following compounds:

- a. rubidium nitrite
- b. potassium sulfide
- c. tin (II) fluoride
- d. magnesium phosphate
- e. tetraphosphorous hexasulfide
- f. hydroiodic acid
- g. iodine heptafluoride
- h. ammonium sulfate
- i. silver perchlorate
- j. boron trichloride

23. Fill in the blanks in the following table:

Cation	Anion	Formula	Name
			Magnesium bicarbonate
		SrCl_2	
Fe^{3+}	NO_2^-		
			Manganese (II) chlorate
		SnBr_4	
Co^{2+}	PO_4^{3-}		
		Cu_2CO_3	
			Lithium nitride
Al^{3+}	S^{2-}		

Chemical Quantities

32. How many moles of cobalt (Co) atoms are there in 6.00×10^9 cobalt atoms?

33. How many moles of calcium (Ca) atoms are in 77.4 g of calcium?

34. How many atoms are present in 3.14 g of copper (Cu)?

35. How many molecules of ethane (C_2H_6) are present in 0.334 g of C_2H_6 ?

36. Calculate the molar mass of each of the following substances:

a. NO_2

b. SO_3

c. C_6H_6

d. NaI

e. K_2SO_4

f. $Ca_3(PO_4)_2$

37. The anticaking agent added to Morton salt is calcium silicate, CaSiO_3 . This compound can absorb up to 2.5 times its mass of water and still remain a free-flowing powder. Calculate the percent composition of each element in CaSiO_3 .

38. The empirical formula of a compound is CH. If the molar mass of this compound is about 78 g, what is the molecular formula?

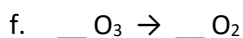
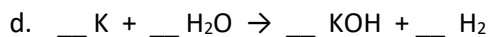
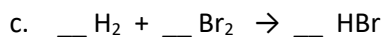
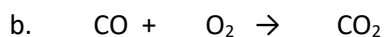
39. What are the empirical formulas of the compounds with the following compositions?

a. 40.1% C, 6.6% H, 53.3% O

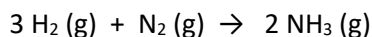
b. 18.4% C, 21.5% N, 60.1% K

Stoichiometry

40. Balance the following equations:



41. Ammonia is a principal nitrogen fertilizer. It is prepared by the following reaction between nitrogen and hydrogen:



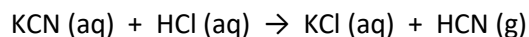
In a particular reaction, 6.0 moles of NH_3 were produced. How many moles of H_2 and how many moles of N_2 were reacted to produce this amount of NH_3 ?

42. When baking soda (sodium bicarbonate or sodium hydrogen carbonate, NaHCO_3) is heated, it releases carbon dioxide gas, which is responsible for the rising of dough in cookies, rolls and donuts.

a. Write the balanced equation for the decomposition of the compound (one of the products is Na_2CO_3).

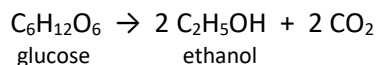
b. Calculate the mass of NaHCO_3 required to produce 20.5 g of CO_2 .

43. When potassium cyanide (KCN) reacts with acids, a deadly poisonous gas, hydrogen cyanide, HCN, is produced via the following reaction:



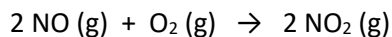
If a sample of 0.140 g of KCN is treated with excess HCl, calculate the amount (in grams) of HCN formed.

44. Fermentation is a complex chemical process during wine making in which glucose is converted into ethanol and carbon dioxide:



Starting with 500.4 g of glucose, what is the maximum amount of ethanol (in both grams and liters) that can be obtained by the process? (The density of ethanol is 0.789 g/mL)

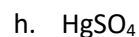
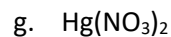
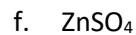
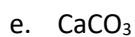
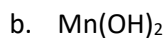
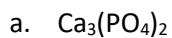
45. Nitric oxide (NO) reacts with oxygen to form nitrogen dioxide (NO₂), a dark brown gas:



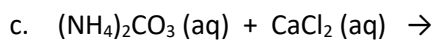
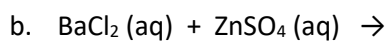
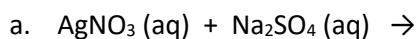
In one experiment, 0.886 mole of NO is mixed with 0.503 mole of O₂. Determine which of these two reactants is the limiting reactant then calculate the number of moles of NO₂ produced.

Aqueous Reactions

46. Characterize the following compounds as soluble or insoluble in water (you may reference an external solubility chart):



47. Predict the products then write the net ionic equations for the following reactions:



48. How many moles of MgCl_2 are present in 60.0 mL of 0.100 M MgCl_2 solution?

49. What volume is required if 35.0 g of KOH are dissolved to make a 5.50 M solution?

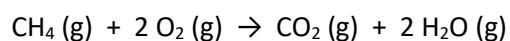
50. What is the molarity if 29.0 g of ethanol ($\text{C}_2\text{H}_5\text{OH}$) is dissolved in 545 mL of solution?

Gasses

51. A sample of nitrogen gas kept in a container of volume 2.3 L and a temperature of 32°C exerts a pressure of 4.7 atm. Calculate the number of moles of gas present.

52. Given that 6.9 moles of carbon monoxide gas are present in a container with volume 30.4 L, what is the pressure of the gas (in atm) if the temperature is 62°C?

53. Methane, the principal component of natural gas, is used for heating and cooking. The combustion process is:



If 15.0 moles of CH_4 are reacted, what is the volume of CO_2 in liters produced at 23.0°C and 0.985 atm?

Acids and Bases

54. Define a (Bronsted) acid. What do acids produce when added to water? Give an example chemical equation for an acid reacting with water.

55. Define a (Bronsted) base. What do bases produce when added to water? Give an example chemical equation for a base reacting with water.

56. Complete the following table. Show your work in the space below.

pH	pOH	$[\text{H}_3\text{O}^+]$	$[\text{OH}^-]$	Acidic or Basic
2.30				
	9.12			
			$4.89 \times 10^{-5} \text{ M}$	
		$6.09 \times 10^{-11} \text{ M}$		
	5.64			
		$2.36 \times 10^{-2} \text{ M}$		