Summary Study Assignment – AP Chemistry

IB Chemistry Summer Assignment

The purpose of this summer assignment is to ensure you remember key information and skills from Chemistry I, and to help you refresh things you may have forgotten, so you will not be behind at the beginning of the school year. Complete the following assignment on separate paper, preferably in a bound notebook. Additionally, you are to complete this assignment in the order it has been assigned. If you complete the assignment at the pace I have laid out for you, it should not be too time consuming, it should serve its purpose well, and we should all be ready for a great new school year. If you do not, you will be ***completely overwhelmed*** *by this assignment and* ***unprepared*** *for the coming school year. If you need additional information beyond what I have provided for you in the boxes, your Chemistry I notes or internet resources should prove useful.*

THIS ASSIGNMENT IS DUE ON THE FIRST DAY OF SCHOOL (WEDNESDAY, AUGUST 8th).

Week One (May 26 - June2)

Review of significant figures, scientific notation, metric conversions, density, & nomenclature:
Significant figures

- Count all numbers as significant except for leading and trailing zeros –placeholders
- Addition and subtraction: Keep the same number of places before or after the decimal as the number with the fewest places before or after the decimal.
- Multiplication and division: The answer should have the same number of significant figures as the number with the fewest total significant figures.

Scientific notation

- Move the decimal until you obtain a number equal to or greater than one and less than ten.
- Count how many places you moved the decimal in order to obtain your exponent. If you moved the decimal to the left, the exponent is positive; if you moved to the right, the exponent is negative.
    - Ex.: $105000 = 1.05 \times 10^{5}$, $0.0032 = 3.2 \times 10^{-3}$
- Addition and subtraction: Since decimal places must line up, exponents have to be the same.

Add or subtract the numbers; exponents do not change.

- Multiplication: Multiply the numbers, and add the exponents.
- Division: Divide the numbers, and subtract the exponents.

Metric conversions & Dimensional analysis

- Review metric units and prefixes
- Remember to line up conversion factors so the units you are trying to get rid of divide out and you are let with the desired units
    - If units are squared or cubed, the entire conversion factor must be squared or cubed.

Density

- Density = mass/volume

Nomenclature

- Ionic: a metal and a nonmetal or a polyatomic ion and a counter ion

Remember, charges must balance out to an overall charge of zero.

- Name the cation first, then the anion.
- For metals that
    - only have one possible charge, simply name the metal
    - have more than one possible charge, the charge must be indicated

- Write the name of the metal followed by roman numerals in parentheses to indicate the charge (stock system) i.e. iron (III)—Fe^{3+} vs. iron (II)—Fe^{2+}

- For nonmetals, change the ending to -ide.

- Covalent: 2 nonmetals or a metalloid and a nonmetal
  - Name the elements in the order in which they appear.
  - Do not change the name of the first element; change the ending of the second element to –ide.
  - Add prefixes to each element to
- Acids: Compounds beginning with hydrogen
  - Binary acids: hydrogen + one other element
    - Add the prefix "hydro-" and change the ending of the element to "-ic"
  - Oxyacids: hydrogen + a polyatomic ion containing oxygen
    - Do not add a prefix
    - If the polyatomic ion ends in –ite, change the ending to –ous.
    - If the polyatomic ion ends in –ate, change the ending to –ic.

1. **How many significant figures does each of the numbers contain?**
   a. 0.0278 meter
   b. 1.3 centimeter
   c. 1.00 foot
   d. 8021 yards
   e. 7.98×10^{-3} pounds
2. Round the following numbers to three significant figures.
   a. 4325 b. 6.873×10^{3} c. 0.17354
3. Express the following numbers in scientific notation with the indicated number of significant figures:
   a. 0.0000098765 (5 sig. figs)
   b. 10,000 (2 sig. figs)
4. **Express the following as ordinary numbers:**
   a. 7.51×10^{-7}
   b. 5.43×10^{0}
5. Perform the indicated operations and round your answers to the proper number of significant figures. Assume that all answers were obtained from measurements.
   a. $(2.11 \times 10^{-3}) + (1.54 \times 10^{-3})$
   b. $(1.54 \times 10^{-3}) + (2.11 \times 10^{-2})$
   c. $(4.56 + 18.7)/(1.23 \times 10^{2})$
   d. $(1.23 \times 10^{-2})(4.56 + 1.87)$
6. **Make the following conversions:**
   a. How many cm/sec are in 50 km/hr?
   b. How many miles/hour are in 66 ft/sec?
7. Make the following conversions:
   a. 65 kg to grams
   b. 750 micrograms to grams
   c. 0.25 nanometers to cm
   d. 23.8 milligrams to kg
8. **How many cubic meters (m^3) are there in 1.773×10^{5} cubic decimeters (dm^3)?**
9. The density of silver is 10.5 g/cm^3. What volume of silver metal will have a mass of exactly 2500.0 grams?
10. **What is the mass of 215 L of hydrogen sulfide gas if the density of hydrogen sulfide is 1.54 g/L?**
11. 28.5 grams of iron shot is added to a graduated cylinder containing 45.5 mL of water. The water level rises to the 49.1 mL mark. From this information, calculate the density of iron.
12. **A rectangular block of copper metal weighs 1896 grams. The dimensions of the block are 8.4 cm by 5.5 cm by 4.6 cm. From this data, what is the density of copper?**

13. The helium gas stored inside a large weather balloon weighs 13.558 grams. What is the volume of this balloon if the density of helium is 0.1786 g/L?

14. Write the name of the following compound

a. KF

b. $CaSO_4$
c. HCl
d. $SbCl_3$
e. As_4O_{10}
f. NH_4Cl
g. NH_4NO_3
h. IF_5
i. $NaHCO_3$
j. $Ba(OH)_2$
k. $FeCl_3$
l. HF
m. $PbSO_4$
n. KrF_2
o. NaCl
p. P_2O_5

15. Write the formula for the following compounds:

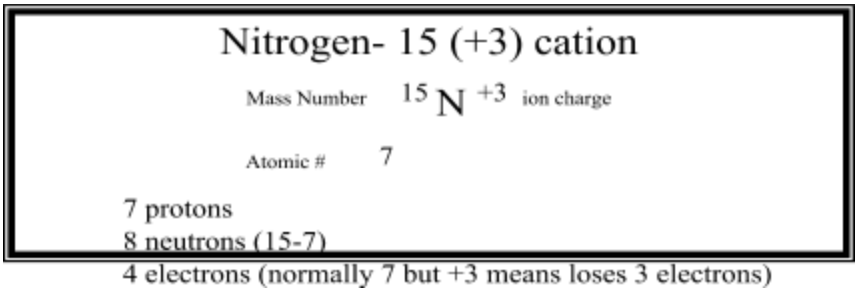
a. ammonium sulfide
b. copper (II) bromide
c. aluminum sulfate
d. potassium nitrite
e. iron (III) carbonate
f. lead (II) phosphate
g. diphosphorus pentoxide
h. manganese (II) hydroxide
i. calcium fluoride
j. tin (II) nitrate
k. silver cyanide
l. ammonium sulfite
m. zinc sulfate
n. antimony (III) chloride
o. silver sulfide
p. magnesium hydroxide
q. ammonium carbonate
r. nickel (II) acetate

Week Two (June 3 - June 9)

Review of atomic structure & chemical reactions:

Atomic structure:

- An atom is made up of protons and neutrons (both found in the nucleus) and electrons (found in the orbitals surrounding the nucleus).
- The atomic number of an element is equal to the number of protons.
- The mass number (different than the average atomic mass) is the sum of the protons and neutrons.
- A charge written in the upper right corner indicates that electrons have been lost or gained.



Chemical reactions:

- Remember to add coefficients to balance all equations.
- Do not forget the seven diatomic elements.
- Review the five reaction types: synthesis, decomposition, single replacement, double replacement, and combustion: How to classify them and predict products

16. Complete the following table

Element/Ion	Atomic Number	Mass Number	# Protons	# Neutrons	# Electrons
^{1}H					
$^{1}H^{+1}$					
^{12}C					
$^{7}Li^{+}$					
$^{35}Cl^{-1}$					

^{39}K					
$^{24}Mg^{+2}$					

17. Write a balanced equation and indicate the reaction type (single or double replacement, decomposition, or composition/synthesis) for each of the following:

a. Aluminum nitrate (aq) + sodium hydroxide (aq) → aluminum hydroxide (s) + sodium nitrate (aq)

b. Potassium chlorate (s) → potassium chloride (s) + oxygen (g)

c. Phosphoric acid (aq) + magnesium hydroxide (aq) → magnesium phosphate (s) + water (l)

d. Ammonium nitrite (s) → nitrogen (g) + water (l)

e. Silver nitrate (aq) + potassium chloride (aq) → silver chloride (s) + potassium nitrate (aq)

18. Write a balanced equation and indicate the reaction type (single or double replacement, decomposition, or synthesis/composition) for each of the following:
    a. Lead (II) nitrate (aq) + copper (II) sulfate (aq) → lead (II) sulfate (s) + copper (II) nitrate (aq)
    b. Aluminum (s) + copper (II) chloride → aluminum chloride (aq) + copper (s)
    c. Iron (s) + silver acetate (aq) → iron (II) acetate (aq) + silver (s)
    d. Ammonium sulfide (aq) + iron (II) nitrate (aq) → ammonium nitrate (aq) + iron (II) sulfide (s)

19. Write the formula for the following compounds

a. sodium chromate

b. zinc bicarbonate

e. potassium phosphate

h. lead (II) chloride

i. calcium chlorate

j. iron (II) bisulfite

j. iron (III) chromate

k. copper(II) hydroxide

l. aluminum perchlorate

20. Write the name of the following compounds:

a. $KMnO_4$
b. NiI_2
c. Cu_2CO_3
d. $AgClO_4$
e. $Mg(NO_3)_2$
f. $FeCrO_4$
g. Hg_2O_2

21. Write a balanced equation and indicate the reaction type (single or double replacement, decomposition, or composition/synthesis) for each of the following:

a. Calcium hydroxide (aq) + nitric acid (aq) →

b. Zinc chloride (aq) + ammonium sulfide (aq) →

c. Silver acetate (aq) + potassium chromate (aq) →

22. Express the following numbers with the indicated number of significant figures.

a. 1000 (2 sig figs)
b. 43,927 (3 sig figs)
c. 0.000286 (3 sig figs)

23. How many cubic meters (m^3) are there in 4312 cubic centimeters (cm^3)?

24. A cylindrical glass tube of length 27.75 cm and the radius 2.00 cm is filled with argon gas. The empty tube weighs 188.25 grams and the tube filled with argon weights 188.87 grams. Use the data to calculate the density of argon gas. (Volume of a cylinder = $\pi r^2 h$.)

Week Three (June 10-16)

Review of stoichiometry:
You must have a balanced chemical equation first.
Line up conversion factors using dimensional analysis.

- grams ↔ moles, same substance: use molar mass
- particles ↔ moles, same substance: Avogadro's number (6.022×10^{23} particles = 1 mol)
- volume of a gas ↔ moles, at STP: use standard molar volume (22.42 L = 1 mol)
- volume of a solution ↔ moles: use molarity (Molarity = moles of solute/ liter of solution)
- moles one substance ↔ moles another substance: use mole ratio (coefficients in balanced equation)

***Key step in all stoichiometry problems.

Limiting reactant problems: when you have more than one given, solve for all to determine the limiting reactant and the amount of product formed.

25. Determine the moles of barium bromate that can be prepared from 7.000 moles of each $HBrO_3$ and $Ba(OH)_2$ given this balanced equation:

$2\ HBrO_3 + Ba(OH)_2 \rightarrow Ba(BrO_3)_2 + 2\ H_2O$.

26. How many molecules of ammonia would be produced if 13.4 grams of nitrogen gas reacted at STP? $N_2(g) + 3\ H_2(g) \rightarrow 2\ NH_3\ (g)$

27. $6\ NaOH + 2\ Al \rightarrow 2\ Na_3AlO_3 + 3\ H_2$

a. What mass of Na_3AlO_3 can be formed from 165.0 grams of sodium hydroxide?

b. How many moles of NaOH are required to produce 3.0 grams of hydrogen?

c. How many mol of hydrogen can be prepared from 1.0 grams of aluminum?

28. Given the reaction $S + O_2 \rightarrow SO_2$

a. How many grams of sulfur must be burned to give 100.0 grams of SO_2?

b. How many grams of oxygen will be required for the reaction in part a?

29. Given the following balanced equation

$4\ Hg\ (l) + O_2\ (g) \rightarrow 2\ Hg_2O\ (s)$

What volume of oxygen gas will be required to produce the 23.7 grams of mercury (I) oxide at STP?

30. $4\ FeCr_2O_7 + 8\ K_2CO_3 + O_2 \rightarrow 2\ Fe_2O_3 + 8\ K_2CrO_4 + 8\ CO_2$

a. How many grams of iron (II) dichromate are required to produce 44.0 grams of carbon dioxide?

b. If 300.0 grams of iron (II) dichromate react, how many grams of oxygen gas will be consumed?

c. How many grams of iron (III) oxide will be produced from 300.0 grams of ferrous dichromate?

31. If 5.00 grams of copper metal react with a solution containing 20.0 grams of $AgNO_3$, which reactant is limiting?

$Cu\ (s) + AgNO_3\ (aq) \rightarrow Cu(NO_3)_2\ (aq) + Ag\ (s)$

32. The thermite reaction has been used to weld railroad tracks. The reaction is

$Fe_2O_3\ (s) + 2\ Al\ (s) \rightarrow 2\ Fe\ (s) + Al_2O_3\ (s)$

How many grams of aluminum would be needed to produce 15.0 grams of iron?

33. If 20.0 grams of KOH react with 15.0 grams of $(NH_4)_2SO_4$, calculate the moles of K_2SO_4 produced. Identify the limiting reactant.

$2\ KOH + (NH_4)_2SO_4 \rightarrow 2\ H_2O + 2\ NH_3 + K_2SO_4$

34. The thermite reaction has been used to weld railroad tracks. The reaction is

$Fe_2O_3\ (s) + 2\ Al\ (s) \rightarrow 2\ Fe\ (s) + Al_2O_3\ (s)$

How many grams of aluminum oxide would be formed if 15.0 grams of iron are used?

35. **What reactant is limiting if 3000 cm^3 of Cl_2 at STP react with a solution containing 25.0 grams of NaBr? $Cl_2 + 2\ NaBr \rightarrow Br_2 + 2\ NaCl$**
36. Write the formula for the following compounds:

a. Sodium phosphate
b. Silver hypochlorite
c. Ammonium phosphate
d. Iron (II) chlorite
e. Potassium sulfide
f. Tin (IV) bromide
g. Lithium chromate
h. Iron (II) phosphate
i. Aluminum acetate
j. Cobalt (III) chloride
k. Sulfurous acid
l. Zinc bisulfite
m. Sodium sulfite

37. Write the names of the following compounds:

a. Hg_2SO_4
b. KH
c. $Co_2(SO_3)_3$
d. N_2O_3
e. N_2O
f. $Fe(NO_3)_2$
g. $Sn_3(PO_4)_2$
h. H_2O_2
i. $Be(OH)_2$

38. Write a balanced equation and indicate the reaction type (single or double replacement, decomposition, or composition/synthesis) for each of the following:
    a. Sulfuric acid (aq) + potassium hydroxide (aq) →
    b. Mercury (II) sulfate (aq) + ammonium nitrate (aq) →
    c. Iron (s) + copper (II) sulfate (aq) →
    d. Zinc (s) + sulfuric acid (aq) →

Week Four (June 17 - 23)

Review of Periodic Table & electron configuration:
Review the Periodic Table, trends, and electron configuration.
Remember how to use your Periodic Table to determine electron configuration.

39. In what order are the elements listed on the PRESENT periodic table?
40. State the periodic law.
41. What name is given to the elements in a vertical column on the periodic table?
42. What name is given to the elements in a horizontal row on the periodic table?
43. What is the most active nonmetal?
44. What is the most active metal?
45. What is the significance of the zig zag line running diagonally down and to the right near the right side of the periodic table?
46. What is electron affinity?
47. What element has the lowest ionization energy?
48. How many electrons are in the valence shell of:

a. the Halogens?
b. the Oxygen family?
c. the alkali metals?
d. the boron family?
e. the neon gases?
f. the alkaline earth metals?
g. the carbon family?
h. the nitrogen family?

49. Each period on the periodic table represents a(n) _____ in the atom.
50. What is meant by nuclear shielding?
51. Why do atomic radii decrease from left to right within a period? Why do they decrease down a group?

52. Arrange each of the following in order of increasing atomic radii:

a. the alkaline earth metals

b. the main group elements in the third period

c. C, Si, Sn, Pb

53. Arrange the following in order of decreasing radius: Br, I, Se, Li.

54. Why does ionization energy increase from left to right across a period?

55. Arrange the members of each of the following sets of elements in order of increasing first ionization energy:

a. the alkali metals
b. the halogens
c. the elements in the second period
d. Br, Cl, B, Ga, Cs, and H

56. Write the electron configuration (long way) for:

a. palladium. **b. sulfur** **c. francium**

57. Write the orbital notation (boxes) for:

a. scandium b. magnesium c. cadmium

58. Write the electron configuration using the Noble Gas core method (shorthand) for

a. radium. **b. lead** **c. californium**

59. Make the following conversions:

a. 9.57×10^{-8} mm to nm
b. 2.00 L to mL
c. 35.38 mL to L
d. 5000 cm^3 to mL

60. Find the mass of 250.0 mL of benzene. The density of benzene is 0.90 g/mL.

61. Write a balanced equation and indicate the reaction type (single or double replacement, decomposition, or composition/synthesis) for each of the following:

a. barium carbonate (s) + hydrochloric acid (aq) →
b. chlorine (g) + magnesium iodide (aq) →
c. aluminum sulfate (aq) + calcium phosphate (s) →
d. iron (s) + hydrochloric acid (aq) →

62. If 81.00 g of H_2O is formed during this reaction, what mass of BaO was used?

$BaO + H_2SO4 \rightarrow BaSO_4 + H_2O$

Week Five (June 24 – 30)

Review of percent composition, empirical formulas, and molecular formulas:
Percent composition:

1. Calculate the mass of the entire compound (molar mass).
2. Calculate the mass the that the component in which you are interested contributes to the compound.
3. Divide the mass due to the component by the molar mass and multiply by 100.

Empirical formula: (simplest whole number ratio of atoms in a compound)

1. Percent to mass: If percent composition is given, assume a 100g sample and change percent sign to grams.
2. Mass to moles: Convert the mass of each element to moles, using molar mass.
3. Divide by small: Divide all answers from step 2 by the smallest mole number from step 2.

4. Multiply 'til whole: If any of the answers from step 3 are not whole numbers, multiple all answers from step 3 by the same number to achieve whole numbers.

Molecular formula: (true formula)

1. Determine the empirical formula.
2. Calculate the mass of the empirical formula.
3. Divide the molar mass of the compound by the mass of the empirical formula to find the ratio between the molecular formula and the empirical formula.
4. Multiply all the atoms (subscripts) by this ratio to find the molecular formula.

63. Calculate the percentage composition of the following compounds:

a. Iron (III) oxide
b. Silver oxide

64. Calculate the percentage of nitrogen in each of the following compounds:

a. NH_4NO_3 b. $(NH_4)_2SO_3$ c. HNO_2

65. Determine the percentage of sodium in sodium sulfate.

66. Calculate the empirical formula of the compounds which have the following percentage compositions:

a. 65.7% Sr, 10.4% Si, and 23.9% O
b. 34.58% Na, 23.30% P, and 42.12% O

67. Chromium exists in four different oxide compounds. From the following data, calculate the empirical formula for a compound containing 0.765 grams Cr and 0.235 grams O.

68. One compound of chromium contains 57.9% chlorine and a second compound contains 67.3% chlorine. What are the empirical formulas of these two chromium chloride compounds?

69. Calculate the empirical formula for a compound containing 70.0 grams of Fe and 30.0 grams of O.

70. Citric acid, an organic acid found in lemons and other fruits, contains 37.5% carbon, 58.3% oxygen, and 4.20% hydrogen. What is the empirical formula of citric acid? What is the molecular formula if it has a molecular mass of 192 amu?

71. Perform the indicated operations and round off your answers to the proper number of significant figures. Assume that all numbers were obtained from measurements.
a. 18.56 + 1.233 b. 1.234 x 0.247 c. 4.3/8.87

72. Make the following conversions:

a. 3.5 L to cm^3
b. 105 m to km
c. 2.0043 x 10^{-5} km to m
d. 1.549 µm to km
e. 1.548 x 10-9 µm to km

73. How many km^3 are there in 4.261 x 10^4 m^3?

74. Write the electron configuration (long way) for yttrium.

75. Write the orbital notation (boxes) for zinc.

76. Write the electron configuration using the Noble Gas core method for mendeleevium.

77. A rubber balloon weighing 144.85 grams is filed with carbon dioxide gas and reweighed. The weight of the balloon plus gas is 153.77 grams. The volume of the balloon filled with carbon dioxide is 4.55 L. What is the density of carbon dioxide?

78. Calculate the density of sulfuric acid if 35.4 mL of the acid has a mass of 65.14 grams.

79. Write the formulas for the following compounds:

a. sodium nitrite
b. silver oxide
c. nickel (II) bromide
d. magnesium oxide
e. mercury (II) perchlorate
f. lithium hypochlorite
g. oxygen difluoride
h. acetic acid
i. barium hypobromite
k. ammonium hydroxide
j. cobalt (II) iodide
k. chromium (II) bicarbonate
l. silver nitrate
m. mercury (II) nitrate
n. hydrochloric acid
o. aluminum bisulfite
p. cobalt (III) bisulfate
q. iron (III) hydrogen carbonate

80. Write the name of the following compounds:

a. N_2O_5
b. $SnCrO_4$
c. Al_2O_3
d. $CuCO_3$
e. ClO_2
f. CuS
g. MgI_2
h. $NaCN$
i. Hg_3N_2

81. Write a balanced equation and indicate the reaction type (single or double replacement, decomposition, or composition/synthesis) for each of the following:
a. cobalt(III) hydroxide (aq) + nitric acid (aq) →
b. bromine (l) + sodium iodide (aq) →
c. ammonium sulfate (aq) + calcium hydroxide (aq) →

82. Calculate the moles of the metal in each of the following compounds:
a. 20.0 grams of chromium (II) chloride
b. 20.0 grams of chromium (III) chloride

83. $NaCl + AgNO_3 \rightarrow AgCl + NaNO_3$
a. If you have 78.00 grams of NaCl, how many grams of AgCl should be produced?
b. **How much AgCl can be produced from 107.0 grams of $AgNO_3$?**

Week Six (July 1 - July 7)

Review of solution concentration:
Molarity (M):
Molarity = moles of solute/liters of solution
molality (*m*):
molality = moles of solute/kilograms of solvent

84. What is the molarity of 5.00 grams of NaOH in 750.0 mL of solution?
85. How many moles of Na_2CO_3 are in 10.0 mL of a 2.0 M solution?
86. **What is the molality of 5.30 grams of Na_2CO_3 dissolved in 400.0 mL water? (The density of water is 1.00 g/mL)**
87. What is the molality of 125.0 grams of H_2SO_4 dissolved in 500.0 mL of water?
88. Determine the molarity of these solutions:
a. 4.67 moles of Li_2SO_3 dissolved to make 2.04 L of solution.
b. 0.629 moles of Al_2O_3 to make 1.500 liters of solution.
c. 4.783 grams of Na_2CO_3 to make 10.00 liters of solution.
89. Determine the final volume of these solutions:
a. 4.67 moles of Li_2SO_3 is dissolved to make a 3.89 M solution.
b. 4.907 moles of Al_2O_3 is dissolved to make a 0.500 M solution.
90. Calculate the number of cubic centimeters (cm^3) in 1.6 cubic meters (m^3).
91. Calculate the empirical formula of the compounds which have the following percentage compositions:

a. 40.2 % K, 26.9% Cr, and 32.9% O
b. 21.8 % Mg, 27.9% P, and 50.3% O

92. Perform the indicated operations and round off your answers to the proper number of significant figures. Assume that all numbers were obtained from measurements.

a. $(1.54 \times 10^3) + (2.11 \times 10^3)$
b. $(1.54 \times 10^3) + (2.11 \times 10^2)$
c. $(1.23 \times 10^2)/(4.56 + 18.7)$
d. $(4.56 + 8.7)/(1.23 \times 10^{-2})$

93. Make the following conversions:

a. 7.8825×10^5 mm to cm
b. 5.79×10^{-8} m to mm
c. 6.24×10^8 km to cm
d. 0.0031 km to m
e. 50,000 MHz to kHz

94. How many m^3 are there in 5,240 dm^3?

95. A small object is found to have a volume of 3.44×10^{-4} mL. Express this length in dm^3.

96. A flask built to hold exactly 2.5000 L is filled with nitrogen. The mass of the nitrogen in the flask at standard conditions is 0.1250 grams. What is the density of the nitrogen?

97. Write the formulas for the following compounds:

a. Phosphorus pentabromide
b. Nickel (II) chloride hexahydrate
c. Iron (III) hydrogen carbonate
d. Mercury (I) bicarbonate
e. Lead (IV) hydrogen sulfate
f. Mercury (I) bisulfite
g. Copper (II) sulfate pentahydrate
h. Sodium acetate
i. Zinc sulfite
j. Silver sulfide
k. Potassium iodide
l. Lead (IV) chlorite
m. Mercury (I) chromate
n. Lead (II) nitrite
o. Potassium dichromate
p. Magnesium carbonate
q. Calcium hydroxide

98. Write the name of the following compounds:

a. BrO_3 (not an ion)
b. SiF_4
c. Sb_2O_5
d. LiH
e. SF_6
f. KOH
g. SnI_4
h. K_2O
i. H_2SO_4

99. Write a balanced equation and indicate the reaction type (single or double replacement, decomposition, or composition/synthesis) for each of the following:
a. Sodium hydroxide (aq) + sulfuric acid (aq) → sodium sulfate (aq) + water (l)
b. Magnesium (s) + oxygen (g) → magnesium oxide (s)
c. Ammonium phosphate (aq) + barium hydroxide (aq) →

100. An essential amino acid which cannot be made (synthesized) by the body and must be obtained in the diet is methionine. What is the percentage of carbon, nitrogen, and sulfur in this amino acid if the formula of methionine is $CH_3SCH_2CH_2CHNH_2COOH$?

101. Write the electron configuration (long way) for barium.

102. Write the orbital notation (boxes) for selenium.

103. Write the electron configuration using the Noble Gas core method for protactinium.

104. Given the following balanced equation

$$4\ Hg\ (l) + O_2\ (g) \rightarrow 2\ Hg_2O\ (s)$$

How many grams of oxygen will be required to react with 67.3 grams of Hg?

105. Arrange the members of each of the following sets of elements in order of increasing electron affinities:

a. the Group IA metals
b. the Group IVA elements
c. the elements in the second period
d. Li, K, C, F, and Cl

106. Arrange the following elements in order of increasing electron affinities: P, S, Cl, and I.

107. Explain the trend in size of either the atom or ion as one moves down a group.

108. What is electronegativity? How does it compare to electron affinity?

Week Seven (July 8 - 14)

Review of gases:
Remember temperature must be in Kelvin anytime you are working with gases.

Combined gas law

Use for changing conditions of a single gas.

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

Ideal gas law

Use when mass or moles of a gas are referred to, and you are not at STP.

$PV = nRT$

Dalton's law

For a mixture of gases, the total pressure is equal to the sum of partial pressures of the individual gases.

$$P_{total} = P_1 + P_2 + P_3 \ldots$$

109. A rigid container holds a gas at a pressure of 0.55 atm at –100°C. What will the pressure be when the temperature is increased to 200°C?

110. What is the volume of a sample of oxygen gas that has a mass of 50.0 grams and is under a pressure of 1.20 atm at 27.0°C?What is the volume at STP of a sample of CO_2 that has a volume of 75.0 mL at 30.0°C and 680 mm Hg?

111. What is the volume of a sample of oxygen gas that has a mass of 50.0 grams and is under a pressure of 1.20 atm at 27.0°C?

112. If 20.0 dm^3 of methane, CH_4, react with 200.0 dm^3 of air, calculate the grams of carbon dioxide produced.

$$\mathbf{CH_4\ (g) + 2\ O_2\ (g) \rightarrow CO_2\ (g) + 2\ H_2O\ (l)}$$

113. If 20.0 grams of KOH react with 15.0 grams of $(NH_4)_2SO_4$, calculate the following:

$$2\ KOH + (NH_4)_2SO_4 \rightarrow 2\ H_2O + 2\ NH_3 + K_2SO_4$$

a. the grams of NH_3 produced
b. the cm^3 of NH_3 produced at STP

114. Determine the total pressure of a gas mixture that contains CO, Ne, and He if the partial pressures of the gases are P_{CO} = 1.53 atm, P_{Ne} = 0.82 atm, and P_{He} = 0.34 atm.

115. Ammonia is produced by the reaction of nitrogen and hydrogen according to this balanced equation:

$$N_2\ (g) + 3\ H_2\ (g) \rightarrow 2\ NH_3\ (g)$$

What volume of ammonia would be produced if 13.4 grams of hydrogen gas reacted at STP?

116. A mass of air occupies a volume of 5.7 L at a pressure of 0.52 atm. What is the new pressure if the same mass of air at the same temperature is transferred to a 2.0 L container?

117. Round off the following to three significant figures.

a. 4.76200 b. 0.0299817 c. 506789.2

118. Make the following conversions:

a. 3.44×10^{-6} cm to hm
b. 10.00 kg to mg
c. 0.6321 kg to g
d. 458 cg to mg

119. How many dm^3 are there in 6.245101 cm^3?

120. Calculate the number of L in 8,062.95 cm^3.

121. What is the weight of ethyl alcohol that exactly fills a 200.0 mL container? The density of ethyl alcohol is 0.789 g/mL.

122. Calculate the density of helium in g/L if a balloon with a capacity of 5.00 L holds 0.890 grams.

123. Write the formulas for the following compounds:

a. cobalt (II) oxide
b. ammonium chromate
c. nitrogen triiodide
d. ammonium dichromate
e. ammonium perchlorate
f. cobalt (II) hydroxide
g. iron (II) chromate
h. iron (III) bromide
i. zinc sulfate
j. iron (III) carbonate
k. ammonia
l. nitric acid

124. Write the name of the following compounds:

a. $NaOH$
b. NI_3
c. ClF_3
d. P_3H_5
e. UF_6
f. NBr_3
g. Cl_2O_3
h. CsF
i. CO
j. **Cu_2S**

125. Write the electron configuration using the Noble Gas core method for gold.

126. **Write a balanced equation and indicate the reaction type (single or double replacement, decomposition, or composition/synthesis) for each of the following:**

a. Ammonium nitrite (s) → nitrogen (g) + water (l)
b. Ammonia (g) + oxygen (g) → nitrogen (II) oxide (g) + water (l)
c. Barium chloride (aq) + sodium sulfate (aq) → sodium chloride (aq) + barium sulfate (s)
d. Magnesium hydroxide (aq) + phosphoric acid (aq) → magnesium phosphate (s) + water (l)

127. Calcium dihydrogen phosphate is an important fertilizer. What is the percent phosporus in $Ca(H_2PO_4)_2$?

128. How much boron can be obtained from 10.00 grams of diboron trioxide? How much magnesium?

$$\mathbf{B_2O_3 + 3\ Mg \rightarrow 3\ MgO + 2B}$$

129. If 20.0 L of methane, CH_4, react with 200.0 L of oxygen, calculate the mass of water produced.

$$CH_4\ (g) + 2\ O_2\ (g) \rightarrow CO_2\ (g) + 2\ H_2O\ (l)$$

130. Nitrogen gas in a steel cylinder is under a pressure of 150 atm at 27°C. What will be the pressure in the tank if the tank is left in the sun and the temperature rises to 55°C?

131. Determine the molarity of these solutions:

a. 0.894 grams of $(NH_4)_2CO_3$ to make 250 mL of solution.
b. 0.0348 grams of $PbCl_2$ to form 45.0 mL of solution.

132. Two compounds are analyzed and found to contain:

a. 0.89 grams K, 1.18 grams Cr, and 1.27 grams O

b. 1.03 grams K, 0.69 grams Cr, and 0.84 grams O

Determine the empirical formulas for these two compounds.

Week Eight (July 15 - 21)

****You will have a quiz over elements, ions, and compounds every week. Your first quiz will be over elements 1-88; you must know element names with the correct spelling and the corresponding chemical symbol. Start reviewing your monatomic and polyatomic ions so you know them.****

133. How many significant figures does each of the numbers contain?

a. 0.2003 ton

b. 4.69×10^4 tons

c. 1×10^{12} atoms

d. 1.73×10^{24} atoms

134. Make the following conversions:

a. .002023 mg to kg

b. 89.00 grams to cg

c. 0.00031 grams to dg

d. 62,000 mg to dkg

135. A book is found to have a mass of 0.6321 kg. Calculate its mass in grams and its density if its volume is 12 cm^3.

136. Calculate the number of dm^3 in 1000 cm^3.

137. Mercury metal is poured into a graduated cylinder that holds exactly 22.5 mL. The mercury used to fill the cylinder weighs 306.0 grams. From this information, calculate the density of the mercury.

138. Write the names for the following compounds:

a. $KHCO_3$

b. $SbCl_5$

c. HgO

d. PCl_3

e. PBr_5

f. IF_7

g. Cl_2O

h. CCl_4

i. NO

139. Write the electron configuration (long way) for carbon.

140. Write the orbital notation (boxes) for chlorine.

141. **Write a balanced equation and indicate the reaction type (single or double replacement, decomposition, or composition/synthesis) for each of the following:**

a. Iron (III) bromide (aq) + ammonium sulfide (aq) → iron (III) sulfide (s) + ammonium bromide (aq)

b. Calcium oxide (s) + diphosphorus pentoxide (s) → calcium phosphate (s)

c. Sodium carbonate (aq) + sulfuric acid (aq) → sodium sulfate (aq) + carbon dioxide (g) + water (l)

d. Iron (II) sulfide (s) + hydrochoric acid (aq) → iron (II) chloride (aq) + hydrogen sulfide (g)

142. The sugar substitute sodium benzosulfimide (sodium saccharin) has a sweetness of about 500 times that of regular sugar. Calculate the percentage of sodium and carbon in the sweetener if its formula is $C_7H_4O_3SNNa$.

143. SnO_2 is reduced by carbon according to this reaction: $SnO_2 + C \rightarrow Sn + CO_2$.

a. How many liters of CO_2 are produced if 300.0 grams of tin are produced at STP?

b. How many grams of SnO_2 are required to produce 1800.0 grams of tin?

144. If 20.0 grams of hydrogen gas react with 15.0 grams of nitrogen, which gas is the limiting reactant? How many dm^3 of ammonia will be produced? Assume the reaction takes place at STP.

145. The ideal gas law allows us to solve for the number of moles of a contained gas when P, V, and T are known. Is this statement true or false?

146. Determine the number of moles of solute to prepare these solutions:

a. 2.35 L of a 2.00 M $Cu(NO_3)_2$ solution.
b. 16.00 mL of a 0.415 M $Pb(NO_3)_2$ solution.
c. 3.00 L of a 0.500 M $MgCO_3$ solution.

147. **Sea water contains roughly 28.0 grams of NaCl per liter. What is the molarity of sodium chloride in sea water?**

148. How many grams of water vapor will be produced when 1.18 grams of methane gas react completely with oxygen?

CH_4 (g) + 2 O_2 (g) → CO_2 (g) + 2 H_2O (l)

149. White lead contains 80.1% lead, 16.5% oxygen, 3.10% carbon, and 0.260% hydrogen. What is the formula of this compound?

150. Compare the elements Na, B, Al, and C with regard to the following properties:

a. Which has the largest atomic radius?
b. Which has the largest electron affinity?
c. Place the elements in order of increasing ionization energy.

151. Which has the largest ionization energy: N, P, or As? Why?

152. List the four quantum numbers and their symbols. Tell what property of the electron each quantum number describes.

153. What is the Pauli Exclusion Principle?

Week Nine (July 22 - 28)

154. A piece of property is found to be 499 decimeters long. What is the value of this length in centimeters?

155. How many mL are in 5,000.00 dm^3?

156. A sample of seawater has a mass of 159 grams and has a volume of 156 mL. What is its density?

157. Write the names of the following compounds:

a. XeF_4
b. CaH_2
c. As_4O_6
d. CoS
e. N_2O_4
f. H_3BO_3
g. I_2O_5
h. PbO
i. NaBr
j. $Li_2Cr_2O_4$
k. SO_3
l. Hg_2O
m. OsO_4
n. XeF_2
o. $Ca(C_2H_3O_2)_2$
p. $Al(OH)_3$

158. Write the formulas for the following:

a. Calcium sulfide
b. Copper (I) bisulfate
c. Zinc permanganate
d. Iron (III) sulfite
e. Hydrobromic acid
f. Hydrogen cyanide
g. Sulfuric acid
h. Copper (I) sulfate
i. Chromium (III) oxide
j. Aluminum oxide
k. Cobalt (II) bisulfate
l. Barium carbonate
m. Mercury (II) chloride
n. Copper (II) hydroxide
o. Perchloric acid
p. iron (III) phosphate
q. Lead (II) oxide
r. Cobalt (III) chlorate

159. Write the electron configuration (long way) for nitrogen.

160. Write the orbital notation (boxes) for nitrogen.

161. Write the electron configuration using the Noble Gas core method for arsenic.

162. Calculate the percentage composition of the following:

a. HgO **b. Na_2S**

163. For the reaction $2\ KMnO_4 + H_2SO_4 \rightarrow K_2SO_4 + Mn_2O_7 + H_2O$,

a. how many moles of Mn_2O_7 can be formed from 196.0 grams of $KMnO_4$?

b. How many grams of Mn_2O_7 can be formed from 390.0 grams of $KMnO_4$?

164. KOH with a mass of 50.0 grams is neutralized by 20.0 grams of sulfuric acid. The products are potassium sulfate and water. Calculate the following:

a. the moles of potassium sulfate produced

b. the grams of water produced

165. What is the temperature of the gas inside a 750 mL balloon filled with 0.300 grams of H_2 gas? The pressure of the balloon is 1.2 atm.

166. A 20.0 L container is filled with nitrogen gas at STP. Then 71 L of hydrogen gas is introduced into the container, still at STP. If the reaction had gone to completion, what would the pressure in the container be?

$$\mathbf{N_2 + 3\ H_2 \rightarrow 2\ NH_3}$$

167. How many grams of water vapor will be produced when 1.18 grams of oxygen react completely with hydrogen to form water?

168. What weight in grams of KCl is there in 2.50 L of a 0.50 M KCl solution?

169. What is the molarity of a solution containing 12.0 grams of NaOH in 250.0 mL of solution?

170. How many moles of NaCl are contained in 100.0 mL of a 2.00 M solution?

171. How does the charge of the ion relate to the element's position on the periodic table?

172. What are the trends down a family and across a period for:

a. Atomic radius **c. Electronegativity** **e. Metallic character**

b. Ionization energy **d. Electron affinity**

173. Arrange the members of each of the following sets of elements in order of increasing electronegativities:

a. S, Na, Mg, Cl **c. Se, Ba, F, Si, Sc**

b. P, N, Sb, Bi

174. Which has the larger radius, Br or Br^-? Why?

175. For the compound sodium sulfate decahydrate, $Na_2SO_4 \cdot 10\ H_2O$, calculate the following:

a. % Na b. %O c. $\%H_2O$

176. Calculate the empirical formulas for the following:

a. Fe 77.7% and O 22.3 % b. Fe 72.4 % and O 27.6 %

Week Ten (July 29 – August 4)

177. Calculate the number of kilometers in 105 meters.

178. There are 5,280 feet in one mile, 1760 yards in 1600 meters, 39.3 inches in one meter, and . You are a middle-distance runner. Calculate the following:

a. Is the 800 meters longer or shorter than 880 yards?

b. How many inches are in 800 meters?

c. Is the 3200 meter relay longer or shorter than the two-mile relay?

179. You fill a 1.00 L balloon with 0.054 grams of air. What is the density of the air in the balloon?

180. Write the formulas for the following:

a. Mercury (II) fluoride
b. Potassium chloride
c. Potassium permanganate
d. Potassium perchlorate
e. Zinc oxide
f. Barium hydroxide
g. Calcium carbonate
h. Barium phosphate
i. Iron (III) oxide
j. Carbonic acid
k. Sodium bisulfate
l. Phosphorus pentafluoride
m. Silver oxide
n. Lead (II) chlorite
o. Copper (I) chromate
p. Calcium perchlorate
q. Acetic acid

181. Write the names of the following compounds:

a. $MgCl_2 \cdot 6H_2O$
b. $CuSO_4 \cdot 5H_2O$
c. $NaHS \cdot H_2O$
d. $Cr(OH)_3$
e. $HClO$
f. $HClO_2$
g. $HClO_3$
h. $HClO_4$
i. $Al(MnO_4)_3$

182. Write the electron configuration (long way) for fluorine.

183. Write the orbital notation (boxes) for phosphorus.

184. Write the electron configuration using the Noble Gas core method for antimony.

185. Write a balanced equation and indicate the reaction type (single or double replacement, decomposition, or synthesis/composition) for each of the following:

a. aluminum acetate (aq) + sodium hydroxde (aq) → aluminum hydroxide (s) + sodium acetate (aq)
b. Bromine (l) + calcium iodide (aq) → calcium bromide (aq) + iodine (s)
c. Calcium hydroxide(aq) + phosphoric acid(aq) → calcium phosphate(s) + water(l)

186. A zinc sample, which has a mass of 40.0 grams, reacts with 20.0 grams of pure HCl. Zinc chloride and hydrogen gas are produced. Calculate the moles of $ZnCl_2$ produced.

187. A volume of 3.0 L of air is warmed from 50ºC to 100ºC. What is the new volume if the pressure remains constant?

188. A sample of gas occupies a volume of 80 mL at a pressure of 0.50 atm and a temperature of 0ºC. What will the new volume be at a pressure of 1.50 atm and a temperature of 50ºC?

189. How many grams of silver iodide can be produced from 52.38 grams of iodine and unlimited silver? I_2 (s) + 2 Ag (s) → 2 AgI

190. If 20.0 dm^3 of methane, CH_4, react with 200.0 dm^3 of air, calculate the dm^3 of carbon dioxide gas produced.

$$CH_4\ (g) + 2\ O_2\ (g) \rightarrow CO_2\ (g) + 2\ H_2O\ (l)$$

191. Ammonia is produced by the reaction of nitrogen and hydrogen according to this balanced equation:

$$N_2\ (g) + 3\ H_2\ (g) \rightarrow 2\ NH_3\ (g)$$

What mass of ammonia would be produced if 13.4 grams of nitrogen gas reacted?

192. Determine the final volume of these solutions:

a. 0.783 grams of Na_2CO_3 is dissolved to make a 0.348 M solution

b. 8.97 grams of $(NH_4)_2CO_3$ is dissolved to make a 0.250 M solution

193. How does the number of valence electrons in an atom relate to the element's position on the periodic table?

194. Name the families in the s block.

195. List the groups in the p block.

196. Name the "families" of the f block.

Week Eleven (July 31 - August 6)

197. Make the following conversions:

a. 2.77 kg to mg
b. 2.90 cm to nanometers
c. 45.6 microliters to kiloliters
d. 1.08 kg to μg

198. A block of lead has dimensions of 4.5 cm by 5.2 cm by 6.0 cm. The block has a mass of 1587 g. From this information, calculate the density of lead.

199. Chromium exists in different oxide compounds. From the following data, calculate the empirical formula of each:

a. 5.60 grams Cr and 2.62 grams O
b. 1.24 grams Cr and 0.76 grams O
c. 0.52 grams Cr and 0.48 grams O

200. Write the formulas for the following compounds:

a. Magnesium sulfate nonahydrate
b. Sodium chromate tetrahydrate
c. Aluminum sulfate
d. Hydrobromic acid
e. Mercury (I) hypochlorite
f. Chromium (III) chloride
g. Phosphoric acid
h. Lithium permanganate
i. Iron (III) hydrogen phosphate
j. Magnesium bicarbonate
k. Tin (II) phosphate
l. Nitric acid
m. Zinc chloride
n. Sodium dihydrogen phosphate
o. Mercurous chloride
p. Tin (IV) carbonate

201. Write the name of the following compounds:

a. $Al(OH)_3$
b. Li_2HPO_4
c. $Ca(NO_3)_2$
d. $Ni(ClO_4)_2$
e. $Mn(NO_3)_2$
f. $Al(C_2H_3O_2)_3$
g. $Al_2(SO_4)_3$
h. $(NH_4)_3PO_4$
i. H_2S

202. Write the electron configuration (long way) for krypton.

203. Write the orbital notation (boxes) for rubidium.

204. Write a balanced equation and indicate the reaction type (single or double replacement, decomposition, or synthesis/composition) for each of the following:

a. Potassium carbonate (aq) + barium chloride (aq) → potassium chloride (aq) + barium carbonate (aq)
b. Cadmium phosphate (s) + ammonium sulfide (aq) → cadmium sulfide (s) + ammonium phosphate (aq)

205. Express the following exponentials as ordinary numbers:

a. 7.23×10^4 b. 8.193×10^2 c. 1.98×10^{-3}

206. The volume of a sample of water is found to be 86.3 cm^3. What is the volume of the sample in mm^3?

207. Calculate the percentage of water in the following compounds:

a. Calcium chloride hexahydrate
b. Calcium chloride monohydrate

208. Determine the moles of Na_2S that can be prepared by the reaction of 0.2240 moles of sodium with 0.1320 moles of sulfur. Which reactant in the limiting reactant?

$$\mathbf{16\ Na + S_8 \rightarrow 8\ Na_2S}$$

209. If 46.2 grams of sulfur trioxide gas decompose into oxygen and sulfur dioxide, how many liters of oxygen gas will be produced at STP?

210. Which has the largest atomic radius: S, Se, or Cl? Why?

211. Which should have the largest difference between the first and second ionization energies: Si, Na, P, or Mg?

212. A volume of 20.0 L of O_2 is warmed from –30.0°C to 85.0°C. What is the new volume, if the pressure is kept constant?

213. **What mass NaCl would be required to make 100.0 mL of a 0.20 M NaCl solution?**

214. What mass of H_2SO_4 would be needed to make 750.0 mL of a 2.00 M solution?

215. **What volume, in mL, of 18.0 M H_2SO_4 is needed to contain 2.45 grams of H_2SO_4?**

216. Complete the following table

Element/Ion	Atomic Number	Mass Number	# Protons	# Neutrons	# Electrons
$^{74}As^{-3}$					
^{108}Ag					
$^{108}Ag^{+1}$					
$^{33}S^{-2}$					
^{238}U					

217. Explain the experiments and the contributions of the following to the development of the model of the atom:

a) Thomson
b) Millikan
c) Rutherford
d) Chadwick

****You will have a quiz over elements, ions, and compounds every week. Your first quiz will be over elements 1-88, plus ; you must know element names with the correct spelling and the corresponding chemical symbol. Start reviewing your monatomic and polyatomic ions so you know them.****

NOMENCLATURE QUIZ 1 *(Elements 1-88) will be on Thursday (August 9th) or Friday (August 10th), depending on Red/Blue day schedule.*

You can expect a nomenclature every Thursday or Friday following that, unless it is replaced by a content quiz. The second quiz will be over polyatomic ions.

Ions to know (plus common oxidation states based on families and stock system for transition metals):

Cations

Ammonium	NH_4^+	
Cadmium	Cd^{2+}	
Hydronium	H_3O^+	
Lead	(II)	Pb^{2+}
	(IV)	Pb^{4+}
Silver	Ag^+	
Strontium	Sr^{2+}	
Tin	(II)	Sn^{2+}
	(IV)	Sn^{4+}
Zinc	Zn^{2+}	

Anions

Acetate, Ethanoate	$C_2H_3O_2^-$	(CH_3COO^-)
Amide	NH_2^-	
Arsenate	AsO_4^{3}	
Bicarbonate, Hydrogen carbonate	HCO_3^-	
Bisulfate, Hydrogen sulfate	HSO_4^-	
Bisulfide, Hydrogen sulide	HS^-	
Bisulfite, Hydrogen sulfite	HSO_3^-	
Borate	BO_3^{3-}	
Bromate	BrO_3^-	
Bromite	BrO_2^-	
Carbonate	CO_3^{2-}	
Chlorate	ClO_3^-	
Chlorite	ClO_2^-	
Chromate	CrO_4^{2-}	
Cyanide	CN^-	
Dichromate	$Cr_2O_7^{2-}$	
Hydride	H^-	
Hydroxide	OH^-	
Hypobromite	BrO^-	
Hypochlorite	ClO^-	
Hypoiodite	IO^-	
Iodate	IO_3^-	
Iodite	IO_2^-	
Nitrate	NO_3^-	
Nitrite	NO_2^-	
Oxalate	$C_2O_4^{2-}$	
Perbromate	BrO_4^-	
Perchlorate	ClO_4^-	
Periodate	IO_4^-	
Permanganate	MnO_4^-	
Peroxide	O_2^{2-}	
Phosphate	PO_4^{3-}	
Phosphite	PO_3^{3-}	
Sulfate	SO_4^{2-}	
Sulfite	SO_3^{2-}	
Thiocyanate	SCN^-	
Thiosulfate	$S_2O_3^{2-}$	