WELCOME TO AP CHEMISTRY

You will be given a syllabus for AP Chemistry on the first day of school in August. Our AP curriculum will include all of the topics and the labs that we will need to complete before the 2018 AP test in May. All of you will find AP chemistry to be challenging, some of you will find it to be down-right hard. There is a lot to cover and while we can do it, we will all need to work very hard. **You should expect this class to be SIGNIFICANTLY more difficult than your first chemistry class.** This means that we cannot slow down if you don't understand a topic. You need to make sure that you are staying up with all assignments and coming in for help if you need extra help.

We need to use our class time effectively so the goal of this summer packet is that you will have reviewed much of the material from your first chemistry class. This assignment should be completed and ready to turn in by the **FIRST day of class** in August 2017, no excuses. We will have a **FIRST day quiz** on the summer material contained in Chapters 1, 2, 21, and 22. We will have a **Second** day quiz on the summer material contained in Chapters 3 and 18. We will spend the first couple of weeks reviewing empirical and molecular formulas and stoichiometry (the rest of Chapter 3). Once we have reviewed stoichiometry, there will be a test covering Chapters 1-3, 21, and 22, with more emphasis on the stoichiometry (Chapter 3) material.

First Day Quiz

1. Polyatomic ions (including name, symbol, and charge)
2. Variable charges for transition metals
3. Naming/formulas acids
4. Naming/formulas ionic compounds
5. Naming/formulas covalent compounds
6. Naming/formulas complex ions
7. Naming/formulas organic compounds
8. Using sig. figs appropriately
9. Periodic Table: Matching names and symbols

Second Day Quiz

1. Balancing equations
2. Balancing nuclear equations
3. Writing equations
4. Molecular weights
5. Mole conversions (mole, mass, particles)
6. Percent composition
7. Half-life calculations

WHY DO WE HAVE TO DO SUMMER WORK?

- It is a review of basic content covered in Honors or General Chemistry, which you may not have seen for over a year.
- It provides the necessary fundamentals you will need to be successful in AP chemistry. To not do the summer assignment or to do it poorly is to seriously endanger your prospects of being successful in AP chemistry.
- There will not be enough time before the AP exam in May to cover the necessary content without this head start.

Students are encouraged to work together to complete the summer assignment. THAT DOES NOT MEAN COPY! You should spread the out the following assignments over several weeks. Do not try to cram them in towards the end of the summer or you will get stressed out before school starts. **AP Chemistry will be taught with the assumption that all students are taking the AP exam in the spring.**

SO WHAT IS THE SUMMER WORK?

All work should be done neatly and clearly on paper and organized in the order it was assigned. All work for every problem **including units throughout** is necessary for AP and expected on the AP exam.

Part 1 - Memorize Charges of Common Ions and Polyatomic Ions and Common Elements on the Periodic Table

- This is a vital part of AP chemistry. They **will not** give you an ion chart or a periodic table with names of elements on the AP Chemistry Exam, so it is essential that you have this done prior to school beginning. I suggest notecards, 8 column notes, mnemonics, and lots of practice.

Part 2 – Read and Take Cornell Style Notes on the Assigned Sections in the Book (think Mini-Skirt: long enough to cover the important things but short enough to keep it interesting)

- **GET USED TO READING! This is ABSOLUTELY necessary for AP Chemistry!**
- Sections: 1.1 – 1.9
  2.1 – 2.8
  3.1 – 3.5, 3.7, and 3.8
  18.1 – 18.3, and 18.6
  21.1 – 21.3
  22.1 – 22.4

Part 3 – Complete the assigned problems at the end of each chapter. Show work, when needed. *Refer to the Show Your Work example page.*

- Chapter 1: Chapter 1 (end of chapter questions) 16, 18, 20, 24, 26, 28, 30, 34, 36, 38, 40, 42, 46, 50, 52, 56, 59, 60, 64, 66, 70, 75
- Chapter 2 (end of chapter questions) 16, 18, 20, 24, 26, 30, 32, 34, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 60, 62, 64, 70, 72, 74, 77, 82
- Chapter 3 (end of chapter questions) 24, 26, 28, 30, 36, 38, 40, 50, 52, 54, 58, 62, 82, 84
- Chapter 18 (end of chapter questions) 14, 15, 16, 20, 23, 25, 26, 28, 33
- Chapter 21 (end of chapter questions) 15, 18, 30, 32, 34
- Chapter 22 (end of chapter questions) 18, 21, 25, 28, 36, 43, 47

Part 4 – Complete (on a separate sheet of paper) the practice problems provided. Show work, when needed. *Refer to the Show Your Work example page.*

Part 5 – Read through the various handouts at the end of this packet.

Part 6 – LAST PART – Come to school in the fall with:

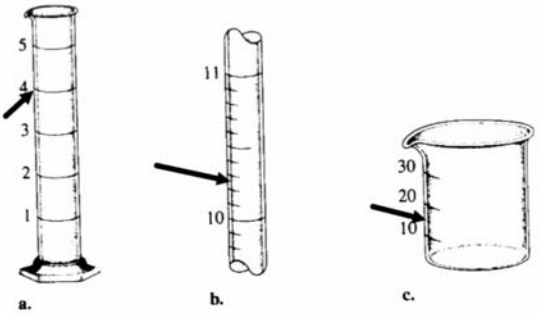
- Your COMPLETED Summer packet stapled in the following order: (make sure EVERYTHING is labeled)
  1. 2-Column notes for the sections in chapters 1-3, 18, 21, and 22
  2. End of chapter questions for chapters 1-3, 18, 21, and 22
  3. Practice problems
- Scientific calculator. No graphing calculators with QWERTY keyboards, because you won't be allowed to use on the AP Chemistry Exam. Cell phone calculators will NOT be allowed.
- A LARGE notebook to be designated exclusively to AP CHEMISTRY
- A composition book with either college ruled or graph paper pages exclusively for AP CHEMISTRY LABS
- ENTHUSIASM AND A GREAT WORK ETHIC!!!!

CONGRATULATIONS, you have made it! Be proud of yourself, and get ready for a fun-filled and challenging year which will push you to your limits, but make you a better student, get you very prepared for college, and prove to yourself how brilliant you really are! Remember, I am on your side, and just want to help! I am trying to give you the tools to succeed, and I pledge I will not ever give you an assignment or make you learn something that is not necessary for your success. If you need anything please do not hesitate to email me! (morgansoutullo@cusd.com) I check my email multiple times each day, so I should be able to respond fairly quickly. Don't be a stranger!
See you in the fall!

Enjoy your summer! See ya'll in the fall!

-Mrs. Soutullo

PRACTICE PROBLEMS
Chapter 1



1. For each of the following pieces of glassware, provide a sample measurement at arrow and discuss the number of significant figures and uncertainty.

2. A student performed an analysis of a sample for its calcium content and got the following results: 14.92%, 14.91%, 14.88%, and 14.91%. The actual amount of calcium in the sample is 15.70%. What conclusion can you draw about the accuracy and precision of these results?

3. Calculate the percent error for the following measurements.
   a. The density of an aluminum block determined in an experiment was 2.64 g/cm3. (Accepted value = 2.70 g/cm3)
   b. The experimental determination of iron in ore was 16.48%. (Accepted value was 16.12%)

4. How many significant figures are in each of the following?
   a. 12
   b. 1098
   c. 2001
   d. 2.001×10^3
   e. 100
   f. 0.0000101
   g. 1000.
   h. 22.04030
   i. 1.00×10^3

5. Round of each of the following numbers to two significant figures, and write the answers in scientific notation.
   a. 0.00031254
   b. 31,254,000
   c. 35,900
   d. 0.00000399

6. Use scientific notation to express the number 480 to
   a. One significant figure
   b. Two significant figures
   c. Three significant figures

7. Perform the following mathematical operations, and express each result to the correct number of significant figures.
   a. 97.381 + 4.2502 + 0.99195
   b. 171.5 + 72.915 – 8.23
   c. $\dfrac{0.102 \times 0.0821 \times 273.5}{1.2}$
   d. (9.04 – 8.23 + 21.954 + 81.0) / 3.1416

8. Precious metals and gems are measured in troy weights in the English system:
   24 grains = 1 pennyweight (EXACT)
   20 pennyweights = 1 troy ounce (EXACT)
   12 troy ounces = 1 troy pound (EXACT)
   1 grain = 0.0648 gram
   1 carat = 0.200 gram
   a. Diamonds are measured in carats. If a lucky girl receives a 5 carat diamond how many pennyweights is it?
   b. What is the mass of 2.3 troy ounces of gold in grams?
   c. The density of gold is 19.3 g/cm3. What is the volume of a troy pound of gold?

9. Apothecaries (druggists) use the following set of measures:
   20 grains ap = 1 scruple (EXACT)
   3 scruples = 1 dram ap (EXACT)
   8 dram ap = 1 oz. ap (EXACT)
   1 dram ap = 3.888 g
   a. An aspirin table contains 5.00 x 102 mg of active ingredient. How many grains ap of active ingredient does it contain?
   b. From (a) how many scruples?
   c. What is the mass of 1.00 scruple in grams?

10. The world record for the hundred meter dash is 9.79 s.
    a. What is the corresponding speed in units of m/s, km/hr, ft/s, and mi/hr?
    b. At this speed how long would it take to run a mile (5,820 ft)?

11. You're planning to buy a new car. One model that you're considering gets 32 miles per gallon of gasoline in highway travel. The one that your spouse likes gets 14 kilometers to the liter. Which car has the better gas mileage? (1 gal = 4 qt., 1.057 qt = 1 L)

12. You pass a road sign saying "New York – 112 km." If you drive at a constant speed of 65 mi/hr., how long should it take you to reach New York?
    a. If your car gets 28 miles to the gallon, how many liters of gasoline are necessary to travel 112 km?

13. You have a 1.0 cm3 sample of lead and a 1.0 cm3 sample of glass. You drop each in separate beakers of water. How do the volumes of water displaced by each sample compare? Explain.
    Density of lead = 11.35 g/cm3
    Density of glass = 3.00 g/cm3

14. A person has a temperature of 102.5 F. What is this temperature on the Celsius scale?
    a. On the Kelvin scale?

15. Convert the following Celsius temperatures to Kelvin and to Fahrenheit degrees.
    a. The boiling-point temperature of ethyl alcohol, 78.1 C
    b. A cold winter day, -25 C
    c. The lowest possible temperature, -273 C
    d. The melting-point temperature of sodium chloride, 801 C

16. The density of diamond is 3.51 g/cm3. What is the volume of a 4.5 carat diamond? 1 carat = 0.200 g

17. The volume of a diamond is found to be 2.8 mL. What is the mass of the diamond in carats? (See question #16)

18. A sample containing 33.42 g of metal pellets is poured into a graduated cylinder initially containing 12.7 mL of water, causing the water level in the cylinder to rise to 21.6 mL. Calculate the density of the metal.

19. Two spherical objects have the same mass. One floats on water; the other sinks. Which object has the greater diameter? Explain your answer.

20. What are some of the differences between a solid, a liquid, and a gas?

21. What is the difference between homogeneous and heterogeneous matter?

22. Classify each of the following as homogeneous or heterogeneous.
    a. Soil
    b. the atmosphere
    c. a carbonated soft drink
    d. gasoline
    e. gold
    f. a solution of ethanol and water

23. Classify each of the following as a mixture or a pure substance. Of the pure substances, which are elements and which are compounds?
    a. Water
    b. Blood
    c. The oceans
    d. Iron
    e. Brass
    f. Uranium
    g. Wine
    h. Leather
    i. Table salt (NaCl)

24. Distinguish between physical and chemical changes.

25. List four indications that a chemical change (reaction) has occurred.

26. If you place a glass rod over a burning candle, the glass appears to turn black. What is happening to each of the following (physical change, chemical change, both, or neither) as the candle burns? Explain each answer
    a. the wax
    b. the wick
    c. the glass rod

27. The properties of a mixture are typically averages of the properties of its components. The properties of a compound may differ dramatically from the properties of the elements that combine to produce the compound. For each process described below, state whether the material being discussed is most likely a mixture or a compound, and state whether the process is a chemical change or a physical change.
    a. An orange liquid is distilled, resulting in the collection of a yellow liquid and a red solid.
    b. A colorless, crystalline solid is decomposed, yielding a pale yellow-green gas and a soft, shiny metal.
    c. A cup of tea becomes sweeter as sugar is added to it.

Chapter 2

1. Describe Dalton's atomic theory.

2. What discoveries were made by J.J. Thomson, Henri Becquerel, and Lord Rutherford? How did Dalton's model of the atom have to be modified to account for these discoveries?

3. What is the distinction between atomic number and mass number?

4. What is the difference between atomic mass and average atomic mass?

5. What is an isotope?

6. How many protons and neutrons are contained in the nucleus of each of the following atoms?
    a. ${}^{42}_{22}Ti$
    b. ${}^{64}_{30}Zn$
    c. ${}^{76}_{32}Ge$
    d. ${}^{86}_{36}Kr$
    e. ${}^{75}_{33}As$
    f. ${}^{41}_{19}K$

7. Write the isotopic symbol for each of the isotopes below.
    a. Atomic number = 8, number of neutrons = 9
    b. The isotope of chlorine in which mass = 37
    c. Atomic number = 27, mass = 60
    d. Number of protons = 26, number of neutrons = 31
    e. The isotope of I with a mass number of 131
    f. Atomic number = 3, number of neutrons = 4

8. The element copper has naturally occurring isotopes with mass number of 63 and 65. The relative abundance of the isotopes are 69.2% for mass = 62.93 amu, and 30.8% for mass = 64.93 amu. Calculate the average atomic mass of copper.

9. An element consists of 1.40% of an isotope with mass 203.973 amu, 24.10% of an isotope with mass 205.9745 amu, 22.10% of an isotope with mass 206.9759 amu, and 52.40% of an isotope with mass 207.9766 amu. Calculate the average atomic mass and identify the element.

10. Distinguish between the terms *family* and *period* in connection to the periodic table. For which of these terms is the term *group* also used?

11. In the periodic table, what is the name of the following groups
    a. Group (2)
    b. Group (18)

12. An ion contains 50 protons, 68 neutrons, and 48 electrons. What is its symbol and charge?

13. Which of the following sets of elements are all in the same group in the periodic table?
    a. N, P, O
    b. C, Si, Ge
    c. Rb, Sn
    d. Mg, Ca

14. Identify each of the following elements:
    a. A member of the same family as oxygen whose most stable ion contains 54 electrons
    b. A member of the alkali metal family whose most stable ion contains 36 electrons
    c. A noble gas with 18 protons in the nucleus
    d. A halogen with 85 protons and 85 electrons

15. Would you expect each of the following atoms to gain or lose electrons when forming ions? What ion is the most likely in each case?

a. Na	c. P	e. I	g. Al
b. Sr	d. Ba	f. O	h. S

16. For each of the following ions, indicate the total number of protons and electrons in the ion. For the positive ions, predict the formula of the simplest compound formed between itself and oxide. For the negative ions predict the simplest compound formed between itself and aluminum.

a. Fe^{+2}	c. Ba^{+2}	e. S^{-2}	g. Br^{-1}
b. Fe^{+3}	d. Cs^{+1}	f. P^{-3}	h. N^{-3}

17. An element's most stable ion forms an ionic compound with bromine, having the formula XBr2. If the ion of element X has a mass number of 230 and 86 electrons, what is the identity of the element, and how many neutrons does it have?

Writing Formulas and Naming Compounds – Do WITHOUT an ion chart! You need to have these memorized.

1. Name each of the following compounds:

a. NaCl	g. CaS	m. $KClO_4$	s. $Pb(NO_3)_2$
b. Rb_2O	h. AlI_3	n. $Al_2(SO_4)_3$	t. $NaNO_2$
c. $FeBr_3$	i. Al_2O_3	o. $BaSO_3$	u. $K_2Cr_2O_7$
d. Cr_2O_3	j. $ZnCl_2$	p. $KMnO_4$	
e. $CaBr_2$	k. Li_3N	q. Sr_3P_2	
f. CsF	l. Ag_2S	r. $Ca_3(PO_4)_2$	

2. Name each of the following compounds:

a. NI_3	c. SO_2	e. SF_2	g. P_2S_5
b. PCl_3	d. ICl_3	f. N_2F_4	h. N_2O_4

3. Name each of the following compounds:

a. HCl	c. HIO_3	e. HI
b. H_3PO_4	d. HNO_2	f. H_2SO_3

4. Name each of the following compounds:

a. HgO	h. NH_4NO_2	o. S_3N_4	v. $Al_2(SO_3)_3$
b. CuI	i. Co_2S_3	p. SF_6	w. SnO_2
c. CuI_2	j. ICl	q. NaClO	x. Na_2CrO_4
d. CoI_2	k. $Pb_3(PO_4)_2$	r. $BaCrO_4$	y. HClO
e. Na_2CO_3	l. KIO_3	s. NH_4NO_3	z. NO
f. $NaHCO_3$	m. $Ca(OH)_2$	t. H_2SO_4	
g. $HC_2H_3O_2$	n. CoS	u. Sr_3N_2	

5. Write the formula for each of the following compounds:

a. Cesium bromide	h. Sulfur difluoride	o. Ammonium acetate
b. Barium sulfate	i. Sulfur hexafluoride	p. Ammonium hydrogen sulfate
c. Chlorine trifluoride	j. Sodium dihydrogen phosphate	q. Cobalt (III) nitrate
d. Ammonium chloride	k. Silicon tetrachloride	r. Copper (I) sulfide
e. Beryllium oxide	l. Lithium nitride	s. Potassium chlorate
f. Chlorine monoxide	m. Chromium (III) carbonate	t. Lithium oxalate
g. Magnesium fluoride	n. Tin (II) fluoride	

6. Write the formula for each of the following compounds:
    a. sodium oxide
    b. Sodium peroxide
    c. Potassium cyanide
    d. Copper (II) nitrate
    e. Silicon tetrafluoride
    f. Lead (II) sulfide
    g. Lead (IV) sulfide
    h. Copper (I) chloride
    i. Cadmium selenide
    j. Zinc sulfide
    k. Ammonium hydrogen phosphate
    l. Hydrobromic acid
    m. Bromous acid
    n. Perchloric acid
    o. Silicon dioxide
    p. Sodium sulfate
    q. Aluminum hydrogen sulfate

Chapter 3

1. Balance the following equations:
    a. _____ CO + _____ O2 → CO2
    b. _____ N2O5 + _____ H2O → _____ HNO3
    c. _____ PCl5 + _____ H2O → _____ H3PO4 + _____ HCl
    d. _____ CH4 + _____ Br2 → _____ CBr4 + _____ HBr
    e. _____ C5H10O2 + _____O2 → _____ CO2 + _____ H2O
    f. _____ Cr(OH)3 + _____ HClO4 → _____ Cr(ClO4)3 + _____ H2O
    g. _____ KNO3 → _____ KNO2 + _____ O2
    h. _____ La2O3 + _____ H2O → _____ La(OH)3
    i. _____ NCl3 + _____ H2O → _____ NH3 + _____ HOCl
    j. _____ Mg3N2 + _____ HCl → _____ MgCl2 + _____ NH4Cl
    k. _____ AgNO3 + _____ K2SO4 → _____ Ag2SO4 + _____ KNO3
    l. _____ Al(OH)3 + _____ H2SO4 → _____Al2(SO4)3 + _____ H2O
    m. _____ CH3NH2 + _____ O2 → _____ CO2 + _____ H2O + _____ N2
    n. _____ (NH4)2Cr2O7 → _____ Cr2O3 + _____ N2 + _____ H2O

2. Write balanced chemical equations to correspond to each of the following descriptions.
    a. When solid potassium chlorate is heated it decomposes to form solid potassium chloride and oxygen
    b. Solid zinc metal reacts with sulfuric acid to form hydrogen gas and an aqueous solution of zinc sulfate.
    c. When liquid phosphorous trichloride is added to water, it reacts to form aqueous phosphorous acid, and hydrochloric acid.
    d. When hydrogen sulfide gas is passed over solid hot iron (III) hydroxide, the resultant reaction produces solid iron (III) sulfide and water vapor.

3. The molecular formula of aspartame, the artificial sweetener marketed as Nutrasweet, is $C_{14}H_{18}N_2O_5$.
    a. What is the molar mass of aspartame?
    b. How many moles of aspartame are present in 3769.4 grams of aspartame?
    c. How many molecules of aspartame are present in 345.9 grams of aspartame?
    d. How many oxygen atoms are present in 23.6 grams of aspartame?
    e. What is the percent composition of aspartame?

4. How many moles of ammonium ions are in 0.557 g of ammonium carbonate?

5. What is the mass, in grams, of 0.0438 moles of iron (III) phosphate?

6. What is the mass, in grams, of 2.69 x 1023 molecules of aspirin, $C_9H_8O_4$?

7. What is the percent carbon in aspirin?

8. What is the molar mass of diazepam (Valium) if 0.05570 mol has a mass of 15.86 g?

9. What is the percent iodate in iron (III) iodate?

Chapter 18

1. Write equations for the following reactions:
   a. The production of ^{56}Mn by neutron bombardment of ^{59}Co.
   b. The production of the new element dubnium by bombarding elements of $^{249}_{98}$Cf with $^{15}_{7}$N nuclei.
   c. The conversion of potassium-40 to argon-40 by electron capture.
   d. The production of carbon-14 in the upper atmosphere by neutron bombardment of $^{14}_{7}$N.

2. In each of the following nuclear reaction, supply the missing particle.
   a. $^{42}_{19}K \rightarrow {}^{0}_{-1}e + \_\_\_\_\_$
   b. $^{9}_{4}Be \rightarrow {}^{9}_{4}Be + \_\_\_\_\_$
   c. $^{6}_{3}Li \rightarrow {}^{4}_{2}He + \_\_\_\_\_$
   d. $^{239}_{94}Pu \rightarrow {}^{4}_{2}He + \_\_\_\_\_$
   e. $^{235}_{92}U \rightarrow \_\_\_\_\_ + {}^{231}_{90}Th$
   f. $\_\_\_\_\_ \rightarrow {}^{142}_{56}Ba + {}^{91}_{36}Kr + 3{}^{1}_{0}n$

3. The half-life of Molybdenum-99 is 67.0 h. How much of a 1.000 mg sample is left after 335h?

4. A living plant contains approximately the same fraction of carbon-14 as in atmospheric carbon dioxide. Assuming that the rate of decay of carbon-14 from a living plant is 13.6 counts per minute per gram of carbon, how many counts per minute per gram of carbon will be measured from a 15000 year old sample? Will radiocarbon dating work well for small samples of 10 mg or less? (Carbon-14 half-life = 5730 years)

5. At a flea market in 2000, you've found a very interesting painting done in the style of Rembrandt's "dark period"(1642- 1672). You suspect that you really do not have a genuine Rembrandt, but you take it to the local university for testing. Living wood shows a carbon-14 activity of 15.3 counts per minute per gram. Your painting showed a carbon-14 activity of 15.1 counts per minute per gram. Could this be a Rembrandt?

6. A rock contains 0.688 mg of lead-206 for every 1.00 mg of uranium-238 present. Assuming that no lead was originally present, that all the lead-206 formed over the years has remained in the rock, and that the number of nuclides in intermediate stages of decay between the uranium and lead is negligible, calculate the age of the rock. Uranium's half-life is 4.5 x 10^9 years.

Chapter 21

1. Determine the oxidation number for each of the transition metal atoms or ions.
   a. $[V(OH_2)_6](NO_3)_3$
   b. $(NH_4)_2[CoCl_4]$
   c. $[Co(py)_4]Br_2$
   d. K4[Mn(CN)6]
   e. $[Co(P(CH_3)_3)_4]_2(SO_4)_3$
   f. $Ni(NH_3)_4Cl_2$

2. Put the following compounds together to give the formula of the compound.
   Remember to use [ ] to identify the complex ion in ionic complexes.
   Where you need a counter ion to produce a neutral compound, use either K^+ or SO_4^{-2}.
   Remember to list the cation first, followed by anion for ionic compounds.

Metal/charge	Ligands	Formula
a. V^{+3}	Four H_2O and two SCN	$[V(OH_2)_4(SCN)_2]SO_4$
b. Co^{+2}	Four Br	
c. Ru^{+3}	Three oxalates	
d. Os^{+3}	Three dppe	
e. Ni^{+2}	Two Br^-, two NH_3, and two CN	
f. Fe^{+3}	Six CN^-	

3. Write formulas for the following.
   a. potassium hexacyanoferrate(III)
   b. sodium hexafluoroaluminate
   c. Pentaaquabromomanganese(III) sulfate
   d. hexaamminechromium(III) nitrate
   e. sodium tetrahydroxochromate(III)
   f. hexaammineruthenium(III) tetrachloronickelate(II)
   g. tetraamminecopper(II) pentacyanohydroxoferrate(III)
   h. potassium diaquatetrabromovanadate(III)

4. Name the following.
   a. $K_4[Ni(CN)_4]$
   b. $(NH_4)_3[Fe(SCN)_6]$
   c. $Na_2[Ni(CN)_4]$
   d. $[Fe(ox)_3]^{3-}$
   e. $[Co(NH_3)_5Cl]Br_2$
   f. $[Cr(OH_2)_4Cl_2]Cl$
   g. $[Pt(NH_3)_2]Cl_2$
   h. $Na_2[MoOCl_4]$
   i. $[Cr(OH_2)_6](NO_3)_3$
   j. $[Fe(NH_3)_6]SO_4$
   k. $(NH_4)_2[CoCl_4]$
   l. $Cr(NH_3)_4Cl_2$
   m. $[Co(P(CH_3)_3)_4]_2(SO_4)_3$
   n. $[Ni(OH_2)_6]Cl_2$

5. Provide the name or chemical formula for the following complex compounds or ions.
   a. $[Al\ (OH_2)_6]\ Br_3$
   b. $[Cr\ (NH_3)_6]\ Cl_3$
   c. potassium hexafluoroferrate (III)
   d. tetrahydroxozincate (II) ion
   e. $[Co\ (OH_2)_4Cl_2]\ Cl$
   f. $[Cu\ (NH_3)_4]^{+2}$
   g. potassium hexachlorostannate (IV)
   h. tetraamminedichloroplatinum (IV) hexachloroplatinate (IV)

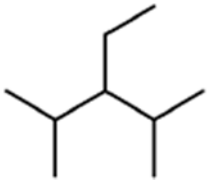
Chapter 22:

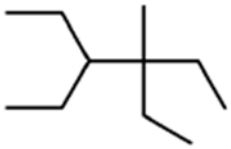
1. Give the name for the following:
   a. C_3H_8
   b. C_5H_8
   c. C_2H_4
   d. C_7H_{16}
   e. C_8H_{16}
   f. $C_{10}H_{22}$

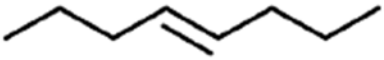
2. Give the chemical formula for the following:
   a. Butane
   b. Octyne
   c. Propene
   d. Pentane
   e. Nonene
   f. Ethyne

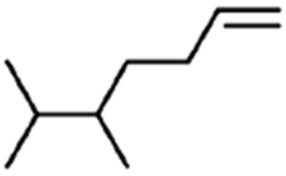
3. Draw the structural formulas for the following:
   a. 3-heptyne
   b. 3-phenyl-2,2-dimethylhexane
   c. 2-Methyl-3-octene
   d. 2,4-dimethyl-trans -2-pentene
   e. 3-heptene
   f. 3-methyl-cis-2-pentene

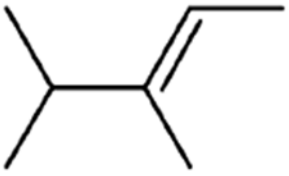
4. Write the names of the following:

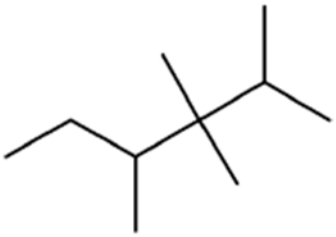
a. 

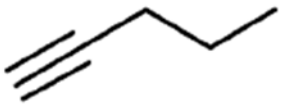
b. 

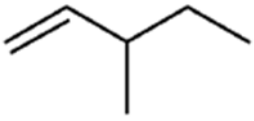
c. 

d. 

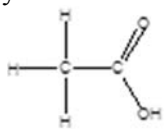
e. 

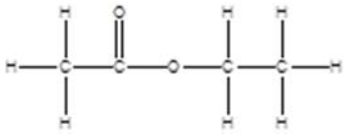
f. 

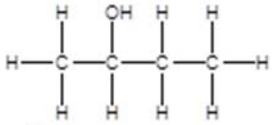
g. 

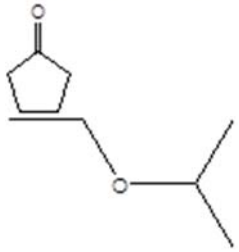
h. 

5. Identify the functional groups in the following:

a. 

b. 

c. 

d. 

e.

AP CHEMISTRY ION SHEET

MONATOMIC IONS (contain 1 type of atom) *Just memorize the periodic trend for this one, not every ion listed*

Periodic Table Connections

Positive Ions (metals) Negative Ions (nonmetals)

Group 1		Group 2		Group 13 or 3A		Group 14 or 4A		Group 15 or 5A		Group 16 or 6A		Group 17 or 7A	
Alkali metals		**Alkaline Earth metals**		**Boron**		**Carbon**		**Nitrogen**		**Oxygen**		**Halogens**	
+1		**+2**		**+3**		**-4 or +4**		**-3 or +5**		**-2**		**-1**	
Li^{+1}	Lithium	Be^{+2}	Beryllium	Al^{+3}	Aluminum	C^{-4}	Carbide	N^{-3}	Nitride	O^{-2}	Oxide	F^{-1}	Fluoride
Na^{+1}	Sodium	Mg^{+2}	Magnesium	Ga^{+3}	Gallium			P^{-3}	Phosphide	S^{-2}	Sulfide	Cl^{-1}	Chloride
K^{+1}	Potassium	Ca^{+2}	Calcium			Si^{+4}	Silicon (IV)			Se^{-2}	Selenide	Br^{-1}	Bromide
Rb^{+1}	Rubidium	Sr^{+2}	Strontium			Ge^{+4}	Germanium (IV)	As^{+5}	Arsenic (V)			I^{-1}	Iodide
Cs^{+1}	Cesium	Ba^{+2}	Barium					Bi^{+5}	Bismuth (V)				
Fr^{+1}	Francium	Ra^{+2}	Radium										

VARIABLE CHARGES/TRANSITION METALS:

Hydrogen	H^{+1} or H^{-1}	Lead (II) or (IV)	Pb^{+2} or Pb^{+4}	NO ROMAN NUMERALS
Iron (II) or (III)	Fe^{+2} or Fe^{+3}	Cobalt (II) or (IV)	Co^{+2} or Co^{+4}	Silver Ag^{+1}
Copper (I) or (II)	Cu^{+1} or Cu^{+2}	Manganese (II) or (IV)	Mn^{+2} or Mn^{+4}	Zinc Zn^{+2}
Mercury (I) or (II)	Hg_2^{+2} or Hg^{+2}	Chromium (II) or (III)	Cr^{+2} or Cr^{+3}	Cadmium Cd^{+2}
Tin (II) or (IV)	Sn^{+2} or Sn^{+4}			Nickel Ni^{+2}

POLYATOMICS IONS (contain more than 1 type of atom) *These MUST be memorized*

+1		-1				-2		-3	
NH_4^{+1}	Ammonium	CH_3COO^{-1} or $C_2H_3O_2^{-1}$	Acetate	OH^{-1}	Hydroxide	CO_3^{-2}	Carbonate	PO_4^{-3}	Phosphate
H_3O^{+1}	Hydronium	BrO_4^{-1}	Perbromate	IO_4^{-1}	Periodate	CrO_4^{-2}	Chromate	PO_3^{-3}	Phosphite
		BrO_3^{-1}	Bromate	IO_3^{-1}	Iodate	$Cr_2O_7^{-2}$	Dichromate		
		BrO_2^{-1}	Bromite	IO_2^{-1}	Iodite	$C_2O_4^{-2}$	Oxalate		
		BrO^{-1}	Hypobromite	IO^{-1}	Hypoiodite	O_2^{-2}	Peroxide		
		HCO_3^{-1}	Hydrogen carbonate or bicarbonate	NO_3^{-1}	Nitrate	HPO_4^{-2}	Hydrogen phosphate		
		ClO_4^{-1}	Perchlorate	NO_2^{-1}	Nitrite	SiO_3^{-2}	Silicate		
		ClO_3^{-1}	Chlorate	MnO_4^{-1}	Permanganate	SO_4^{-2}	Sulfate		
		ClO_2^{-1}	Chlorite	$H_2PO_4^{-1}$	Dihydrogen phosphate	SO_3^{-2}	Sulfite		
		ClO^{-1}	Hypochlorite	HSO_4^{-1}	Hydrogen sulfate or bisulfate	$S_2O_3^{-2}$	Thiosulfate		
		CN^{-1}	Cyanide	HSO_3^{-1}	Hydrogen sulfite or bisulfite				
		SCN^{-1}	Thiocyanate	HS^{-1}	Hydrogen sulfide or bisulfide				

Diatomic elements: (BrINClHOF) Br_2 I_2 N_2 Cl_2 H_2 O_2 F_2 Polyatomic elements: P_4 and S_8

Reminder NH_3 = ammonia

TIPS FOR LEARNING THE IONS

Monatomic Ions - "From the Table"

These are ions can be organized into two groups.

- Their place on the table suggests the charge on the ion, since the neutral atom gains or loses a predictable number of electrons in order to obtain a noble gas configuration. This was a focus in first year chemistry, so if you are unsure what this means, get help BEFORE the start of the year.
    - All Group 1 Elements (alkali metals) lose one electron to form an ion with a 1+ charge
    - All Group 2 Elements (alkaline earth metals) lose two electrons to form an ion with a 2+ charge
    - Group 13 metals like aluminum lose three electrons to form an ion with a 3+ charge
    - All Group 17 Elements (halogens) gain one electron to form an ion with a 1- charge
    - All Group 16 nonmetals gain two electrons to form an ion with a 2- charge
    - All Group 15 nonmetals gain three electrons to form an ion with a 3- charge

Notice that cations keep their name (sodium ion, calcium ion) and tend to be metals while anions get an "-ide" ending (chloride ion, oxide ion) and tend to be nonmetals.

- Metals that can form more than one ion will have their positive charge denoted by a roman numeral in parenthesis immediately next to the name of the element.

Polyatomic Anions

Most of the work on memorization occurs with these ions, but there are a number of patterns that can greatly reduce the amount of memorizing that one must do.

- "ate" anions have one more oxygen then the "ite" ion, but the same charge. If you memorize the "ate" ions, then you should be able to derive the formula for the "ite" ion and vice-versa.
    - Sulfate is SO_4^{2-}, so sulfite has the same charge but one less oxygen (SO_3^{2-})
    - Nitrate is NO_3^-, so nitrite has the same charge but one less oxygen (NO_2^-)

- If you know that a sufate ion is SO_4^{2-} then to get the formula for hydrogen sulfate ion, you add a hydrogen ion to the front of the formula. Since a hydrogen ion has a 1+ charge, the net charge on the new ion is less negative by one.
    - Example: PO_4^{3-} → HPO_4^{2-} → $H_2PO_4^-$
      phosphate — hydrogen phosphate — dihydrogen phosphate

- Learn the hypochlorite → chlorite → chlorate → perchlorate series, and you also know the series containing iodite/iodate as well as bromite/bromate.
    - The relationship between the "ite" and "ate" ion is predictable, as always. Learn one and you know the other.
    - The prefix "hypo" means "under" or "too little" (think "hypodermic", "hypothermic" or "hypoglycemia")
        - Hypochlorite is "under" chlorite, meaning it has one less oxygen
        - The prefix "hyper" means "above" or "too much" (think "hyperkinetic")
        - the prefix "per" is derived from "hyper" so perchlorate (hyperchlorate) has one more oxygen than chlorate.
    - Notice how this sequence increases in oxygen while retaining the same charge:
      ClO^- → ClO_2^- → ClO_3^- → ClO_4^-
      hypochlorite — chlorite — chlorate — perchlorate

NANIMG COMPOUNDS

IONIC compound
(metal + nonmetal)

1. Name the 1st element. Use roman numerals for transition metals with more than 1 oxidation state.
2. Name the 2nd element with the –ide ending.

POLYATOMIC COMPOUNDS
(metal or nonmetal + polyatomic ion)

1. Use the rules for naming ionic compounds.
2. Never modify the name of the polyatomic ion.

ORGANIC
(CxHy) (may also contain N or O)

1. Use the proper prefix to indicate the number of CARBONS
2. Add the proper ending to identify the compound as an alkane, alkene, or alkyne
   a. Alkane: end in –ane and have CnH2n+n formula
   b. Alkene: end in –ene and have CnH2n formula
   c. Alkyne: end in –yne and have CnH2n-2 formula

1	2	3	4	5	6	7	8	9	10
meth-	eth-	prop-	but-	pent-	hex-	hept-	oct-	non-	dec-

COVALENT compound
(nonmetal + nonmetal)

1. Name the 1st element using the proper prefix (never use mono-).
2. Name the 2nd element using the proper prefix with the –ide ending.

Prefixes:

1	2	3	4	5	6	7	8	9	10
mono-	di-	tri-	tetra-	penta-	hexa-	hepta-	octa-	nona-	deca-

ACID
(H + anion)

1. H + monatomic anion
   a. Hydro anion root –ic acid
2. H + polyatomic anion ending in –ate
   a. anion root –ic acid
   b. I -*ate* something –*ic*ky
3. H + polyatomic anion ending in –ite
   a. anion root –ous acid
   b. It m-*ite* be a hippopotam-*ous*.

METRIC SYSTEM (base unit = m, g, L, sec, J, etc.)

Prefix	Symbol	Equality
kilo-	k	1 k base unit = 1000 base units
deci-	d	1 base unit = 10 d base units
centi-	c	1 base unit = 100 c base units
milli-	m	1 base unit = 1000 m base units
micro-	μ	1 base unit = 10^6 μ base units
nano-	n	1 base unit = 10^9 n base units

SHOW YOUR WORK

What does SHOW YOUR WORK even mean? You see it everywhere. It means different things to different people. But when in Chemistry, SHOW YOUR WORK means something very specific. When showing work, you're describing a narrative, giving a step by step recipe for solving a problem. Even if you know how to solve the problem in your head, SHOW YOUR WORK means that you need to know how to express that know-how onto paper. On the AP Chemistry Exam, you MUST show ALL work, including units, or you will lose points. If you get the correct answer but do not show work, you will not receive any points. (Accordingly, in this class and on this summer assignment, credit will NOT be given for answer-only responses!)

I'll use an example, and you may not understand the problem, but the step by step process is how to solve it.
How many grams of sodium are formed when 3.275 L of chlorine gas at 1.25 atm and 300 K react to form sodium chloride?

Step 1: List givens
To perform this calculation, write out what you're given and identify what dimension the value measures. Include units and give the number as written (to keep significant figures). Identify what it is you're trying to find. You can do this by writing the dimension you're looking for and signal it's the missing one with a "?".

Volume = 3.725 L Cl_2
Pressure = 1.25 atm Cl_2
Temperature = 300. K
Grams sodium = ?

$2Na + Cl_2 \rightarrow 2NaCl$

**You were not given the balanced equation, but you know how to write it, so it still should be listed as a given.*

Step 2: Equation(s) solved for unknown variable
Write the equation you are using, and rearrange it to solve for the unknown variable. If you can solve the problem with train tracks (dimensional analysis), then you don't need to write the equation. Just be sure to label everything with units in your train tracks.

$PV = nRT$ $\qquad$ $n = \frac{PV}{RT}$

Step 3: Plug and chug
Be sure to include units when plugging the numbers into the equation(s).

$$n = \frac{1.25 atm\ (3.725\ L)}{0.0821 \frac{L \cdot atm}{mol \cdot K}(300\ K)} = 0.189\ moles\ Cl_2$$

$$0.189\ moles\ Cl_2\ x\ \frac{2\ moles\ Na}{1\ mole\ Cl_2}\ x\ \frac{23\ g\ Na}{1\ mole\ Na} = 8.70\ g\ Na$$

Step 4: Solution CIRCLED with correct sig figs and a unit
If your units don't come out right, then something went wrong. To check this, cross out the units that cancel out in the numerator and denominator. (Check your algebra books for this if this confuses you.)

SHOW YOUR WORK FAQ
Q: Do I have to show my work all the time?
A: When there is math or conversions involved, YES, it is appropriate to show your work.
Q: If I don't, can I lose points?
A: In class, NO WORK = NO CREDIT. On the AP Chemistry Exam, don't make a grader search for the answer. This is also true for incoherent and unclear work.
Q: Is this always how I should show my work?
A: For this class, YES
Q: Should every number have a unit?
A: YES. ALWAYS.* A number without a unit is nothing.
*There are exceptions to this rule, but you will be directed to when this is the case.

DESIRED QUALITIES OF AN AP CHEMISTRY STUDENT

Intelligence

This quality is not just about being "smart". It is being "smart" enough to identify what you do not know or understand and then actively seeking sources of help. This also includes knowing when you "get it", and when you need to stay after/ask for help.

Self-Motivation

This quality describes your attitude. Enrollment in this "honor" level class is voluntary. Your desire to learn the material should be your chief motivation. You understand that the teacher will not cajole, plead, beg, etc. an AP level student to do the assigned work. You should be ready and willing to learn each day.

Integrity / Character

This quality is about doing the right thing in all situations. If you have integrity, you do not cheat on any assignment, be it a test, quiz, project or homework. You do your own work. If you have integrity it means you do not help others to cheat, be it providing homework for someone to copy or providing the questions /answers for a test or quiz in class or for another class.

Work Ethic / Industriousness

This quality means that the work you turn in is of your highest quality. You show complete and organized work on all assignments (tests, quizzes, homework, projects) clearly identifying how you arrived at the solutions. Showing just answers does not show any work ethic at all and is unacceptable. Industriousness means that you use all available time to learn and improve. This could simply be starting your homework if there is time left in class. It could mean asking questions about a concept of which you are unsure. When given an extended problem / project / reading assignment industriousness means that you start on the assignment promptly and not wait until the night before the test or due date. This quality means you do not do work for another class or play games on your calculator during class time.

Safety

AP students treat the lab and lab materials with respect. While they may not yet know all the safety regulations, they do know that horsing around or misbehaving in the lab can potentially cause injury or worse to themselves and their peers. AP students do not need to be told how to behave properly in a lab, or when to appropriately observe safe and correct lab techniques. AP students ensure the lab is cleaner than when they found it. Labs should be read, at a minimum, the night before. You should highlight and write notes on your procedure. All prelab assignments should be done promptly and if there are questions you should discuss those with Mrs. Soutullo BEFORE the class period in which you are supposed to perform the lab.

Inquisitiveness

This quality means that if you have a question you ask the question as soon as possible. An AP student does not just sit there and take notes, they think: Did I understand? Does it make sense? What if? Do not make the mistake of assuming that a concept you do not understand now in class will all make sense later on. Being inquisitive also means taking advantage of all opportunities to help yourself including:

- Your teacher in class
- Your teacher out of class
- Your textbook!
- Other students who may have a grasp of the concept

Ingenuity

This quality is about applying knowledge, not just rote memorization. An AP student is able to solutions to problems they have never seen before. They are able to take what they have cumulatively learned in this class and all of their current and previous classes and apply it toward the solution of a new problem.

AP CHEMISTRY CLASS PERCEPTIONS AND REALITIES

Students need to be realistic about the expectations for this course. Many students THINK they are ready for college level work, but really don't know what that means. In order to get a more realistic view of this course, I have included some perceptions entering students have, and the reality of the situation.

1. **PERCEPTION**: I can miss class (sports, activities, family vacations, jobs, field trips, etc.) and catch up on my own. I always have before.
   REALITY: You can't!!! In AP Chemistry, you have to give up a lot to get a lot. Missing class is the number one reason why students fall behind, get lost, give up, and either drop the class or get a low grade. You cannot be gone for three days, and expect to get caught up with a 10 minute session after school. I cannot teach in 10 minutes what it took 3 hours to teach earlier. (Amazingly some students expect that!)

2. **PERCEPTION**: Like all teachers, Mrs. Soutullo is exaggerating about how much work there is, and how tough it really is.
   REALITY: I'm not exaggerating.

3. **PERCEPTION**: Mrs. Soutullo is making this class a lot tougher than it really needs to be.
   REALITY: Never forget-this is a college level course. NOT an advanced high school course. If I am doing my job, students in this course should learn as much as they would if they were taking Freshman Chemistry at any college or university in the United States. A second goal is to properly prepare students for the AP Exam in May. I cannot make the course easier and still accomplish the above goals. Every former student who has taken Freshman College Chemistry has found he or she had a tremendous advantage over other students. I have NEVER had former students come back and say they wish I hadn't made it so tough.

4. **PERCEPTION**: If the majority of the class falls behind. Mrs. Soutullo will just have to slow down so that we can catch up.
   REALITY: I can't!!! You will find that time is of the essence in this course. As much as I may like to and as much as the students may need it, our schedule cannot be adjusted to accommodate those who cannot keep up. Students will be expected to study the text on their own, and class time will be use more for clearing up questions than for introducing new material. There is really no other way to cover the vast amount of material required by the AP exam. If we slow down to make the course easier, or allow students to catch up, we will not cover the required subject matter, and students will have to face exam questions on material not covered in class. Chemistry topics build on each other, and students who get behind have a (nearly) impossible task in catching up. Students can expect to spend about 30 minutes to one hour outside of class time just in the study of chemistry each night.

5. **PERCEPTION**: All this work Mrs. Soutullo is talking about must be just for the "dummies" I'm smarter than that!
   REALITY: All students who are successful in this course will have to spend time outside of school—either by getting help on an assignment, completing lab work, or reviewing for tests. I WILL be available at lunch, some mornings, and 1 day after school each week. Students will be encouraged to form study groups to get many of their questions answered.

6. **PERCEPTION**: Mrs. Soutullo doesn't really expect us to do a summer assignment, and she isn't really going to give us a quiz on the first and second days of school in August.
   REALITY: I am serious about this—the summer assignment is mainly a review of first year chemistry. The quizzes will encourage you to do most of the memorization for the course before the school year begins. This early work will allow us to spend additional time later on more difficult topics.

7. **PERCEPTION:** I have always been a "straight A" student and always will be.
   REALITY: AP Chemistry can mean **death to a 4.0** grade average. Although there are many A's, there are also B's, C's, D's, and F's. If your main purpose in taking this class is to collect one more A you are taking the class for the wrong reason, and may be disappointed. Remember that a C means you are an average chemistry student doing average work. If you want to be above average, you need to put in above average time and effort.

I will say that this is a very fun course, but it comes with WORK. You should be proud that you are challenging yourself to the limit of your academic ability. **Mrs. Soutullo**