AP Chemistry
Summer Assignment

1. Items listed need to be memorized:
   a. Common Ions and Their Charges
   b. Solubility Rules

2. Read chapter one of Brown and LeMay for understanding. It is expected that you will be familiar already with nearly all of this material. Once you have completed the reading and done the sample and practice problems in the chapter, you are to complete the following problems from the end of the chapter: 1.1, 1.4, 1.5, 1.6, 1.8, 1.11, 1.14, 1.15, 1.17, 1.23, 1.25, 1.27, 1.36, 1.37, 1.39, 1.45, 1.49, 1.53, 1.58, and 1.76. I have included worked out solutions for all the problems listed here (So what's the catch? Couldn't I just copy down the work and hand that in? Well, I'm not going to collect the work from you anyway. Gee great, then why even do it? Because I'm going to test you over the material the first week back after summer vacation. In the past, students who did the work have scored very high on the test, those who didn't scored very low, not a good way to start off the year.). This means there should be no question on how to do any of these problems. If you simply copy the work I provide, you will not survive in this class. You must understand and be able to do any of these assigned problems without looking at the solutions. This continues all year. I strongly suggest you attempt the problems and look at the solutions if you must, but go back and do the problems again until you can do the problems on your own without even having to think about them. I also suggest for the more ambitious to try your hand at any of the questions that are numbered in blue. The answers for these problems are listed in the back of the book.
3. We move on to chapter two. Follow the same suggestions for chapter one. Do the following problems: 2.1, 2.2, 2.4, 2.6, 2.11, 2.17, 2.20, 2.26, 2.30, 2.32, 2.43, 2.46, 2.47, 2.50, 2.52, 2.54, 2.56, 2.60, 2.66, 2.68, 2.70, 2.72, 2.75, 2.88, and 2.99.
4. Chapter three is the last of the chapters we will not cover in class. We will cover a couple parts of chapter three that you are currently not familiar with, and I will not assign problems from those areas. Again, I suggest you read the chapter for understanding. Do the following problems: 3.1, 3.5, 3.8, 3.12, 3.22, 3.25, 3.28, 3.32, 3.36, 3.40, 3.44, 3.50, 3.58, 3.62, 3.69, 3.73, and 3.77
5. I suggest you spend 15 – 30 minutes a day doing work. You will find you can stay focused and it will alleviate those guilt feelings that creep up on you because you haven't been doing your work yet. Summer goes by fast and you will find that small chunks of work are much more agreeable that huge ones. Also, you may even find if you're finding the work easy you may spend even more time on it.
6. Remember, I am available to help you. Take advantage of that if you need to. Don't wait until the last few days. You will be stressed. You can reach me by email dharrington@hhca.org or on my cell 843-415-5647. I will also be going to the school quite often during the summer if you wanted to meet to work out any problems you may be having.

Chapter 1 Matter & Measurement

.1 (a) only i and v only 1 element present as indicated by the blue color only
(i) is a gas, (v) is a solid

(b) only (vi), 2 elements present, but not chemically combined

(c) only (iv) - compound as illustrated by combined colors, only compound present

(d) only (ii) & (iii) - remember as long as only 1 element is present such as in O_2 it is called an element, not a compound

.4 Aluminum < Nickel < silver

$2.70 \frac{g}{cm^3} < 8.90 \frac{g}{cm^3} < 10.49 \frac{g}{cm^3}$

5 (a) (ii) (b) (i) (c) (iii)

6 (a) 7.5 cm, 2 significant figures (the 5 is estimated)
(b) 140, 2 significant figures (the 4 is estimated, the Ø is a placeholder)

3 (a) 2 sig. figs. limited by multiplication rule 2.5 only has 2 sig. figs.
Volume = 17 cm^3 (note rounding of answer)

(b) 2 sig figs division rule
since $D = \frac{m}{V} = \frac{104.7g}{17 cm^3} = 6.2 \frac{g}{cm^3}$

i (a) heterogeneous mixture
(b) homogeneous mixture if we only consider salt and water, but heterogeneous if we consider undissolved substances such as sand or seaweed

Chapter 1 Matter & Measurement (cont.)

1.23 d = deci = 10^{-1}

c = centi = 10^{-2}

f = femto = 10^{-15}

μ = micro = 10^{-6}

M = mega = 10^{6}

K = kilo = 10^{3}

n = nano = 10^{-9}

m = milli = 10^{-3}

p = pico = 10^{-12}

1.25 °C → °F: $1.8(°C) + 32$

°F → °C: $\frac{(°F - 32)}{1.8}$

°C → K: $+273$

(a) 17°C

(b) 422.1°F

(c) 506 K

(d) 108°F

(e) 1.6×10^{3} K

1.27 $D = \frac{m}{V} = \frac{39.73g}{25.0mL} = 1.59 g/mL$ it will not float since it is more dense than H_2O at 1.0 g/mL at 25°C

(b) $D = \frac{m}{V}$ $m = D \cdot V = 21.45 \frac{g}{cm^3} \times 75.00 cm^3 = 1609 g$

(c) $V = \frac{m}{D} = \frac{87.50g}{1.738 \frac{g}{cm^3}} = 50.35 cm^3$

1.49 ? mass in kg

$D = 1.19 \frac{g}{L}$

$12.5\,ft \times 15.5\,ft \times 8.0\,ft$

$= 1550\,ft^3 \times \left(\frac{12\,in}{1\,ft}\right)^3 \times \left(\frac{2.54\,cm}{1\,in}\right)^3 \times \frac{1\,mL}{1\,cm^3} \times \frac{1\,L}{1000\,m}$

$1\,cm^3 = 1\,mL$

$= 43{,}891\,L \times 1.19 \frac{g}{L} = 52230\,g = 52\,kg$

only 2 sig figs due to 8.0 ft

1.53 26.73 g 90% Ag 10% Cu

$\frac{\$1.18}{troy\ oz}$? Value of Ag

31.1 g

$\frac{26.73\,g}{coin} \times .90 = 24.057 \frac{g\,Ag}{coin} \times \frac{troy\,oz}{31.1\,g} \times \frac{\$1.18}{troy\,oz} = \$0.91$

(b) Today $\frac{\$13.25}{31.1\,g}$? Silver dollars for \$25.00 of Pure Ag

Since there are 24.057 g Pure Ag per Ag dollar

$\frac{1\ Ag\ dollar}{24.057\,g} \times \frac{31.1\,g}{troy\ oz} \times \frac{1\ troy\ oz}{\$13.25} \times \$25.00 = 2.44$ Ag dollars

therefore 3 Ag dollars are required

1.58 Vit. C

has 1.50 g C

2.00 g O

other sample

6.35 g C must have 8.47 g O

$\frac{6.35}{1.50} = \frac{x}{2.00}$

Law of Constant Composition (Definite Proportion)

1.76 $V = \pi r^2 h$ $h = 15.0\,cm$

$11.86\,g \times \frac{mL}{0.789\,g} = 15.03\,mL = 15.03\,cm^3$

$15.03\,cm^3 = \pi r^2\, 15.0\,cm$

$1.002\,cm^2 = \pi r^2$

$r = 0.5648\,cm \times 2 =$ diameter of 1.13 cm

Chapter 2 Atoms, Molecules and Ions

2.1 (a) because the plates are charged

(b) ~~charge must be negative attracted to positive plate and repelle~~
by the negative plate

(c) increase, greater energy being used

(d) decrease, with greater mass there is greater inertia (tenden
to stay on the same path)

2.2 8 blue, 12 red, 20 total = 40% blue, 60% red

for blue ^{295}Nv (295.15 amu)(.40) = 118.06 amu

^{293}Nv red (293.15 amu)(.60) = 175.89 amu

293.95 amu

2.4 ion unequal number of p^+ & e^-

$16 p^+$ = Sulfur

$^{32}_{16}S^{2-}$

A (mass # ($p^+ + N^0$)) → 32

2− ← ion charge

16 ← Z atomic #

2.6 must be covalent – all non-metal (molecular) Iodine pentafluoride

2.11 $\frac{17.60}{30.82} = 0.57\ g\ O/g\ N$ $\frac{35.20\ g}{30.82\ g} = 1.14\ g\ O/g\ N$ $\frac{70.40}{30.82} = 2.28$ $\frac{88.00}{30.82} = 2.86$

$\frac{.57}{.57} = 1$ $\frac{1.14}{.57} = 2$ $\frac{2.28}{.57} = 4$ $\frac{2.86}{.57} = 5$

support Dalton's law of multiple proportions
because when the same 2 elements will form more than
n they will always come together in whole number

Chapter 2 Atoms, Molecules & Ions

.30

(a) 12 amu

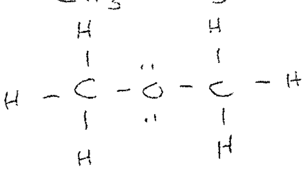
(b) 12.011 amu is the average of all the isotopes of C that exist in nature.
No C atom actually has a mass of 12.011 amu

2.32 (84.9118 amu)(.7215) = 61.26 amu
(86.9092 amu)(.2785) = 24.20 amu
85.46 amu

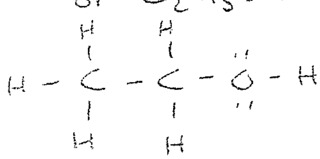
.43 $AlBr_3$
C_2H_5
C_2H_4O
P_2O_5
C_3H_2Cl
BNH_2

.46 4 C
(b) 8 oxy.
(c) 9 H

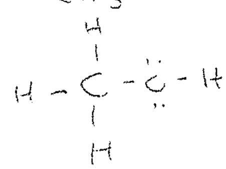
.47 CH_3OCH_3



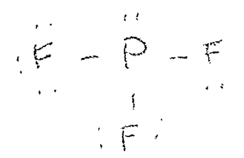
(b) CH_3CH_2OH
or C_2H_5OH



(c) CH_3OH



(d) PF_3



.50

Symbol	$^{31}_{15}P^{3-}$	$^{80}_{35}Cl^{1-}$	$^{115}_{49}In^{3+}$	$^{197}_{79}Au^{3+}$
p^+	15	35	49	79
N^0	16	45	66	118
e^-	18	36	46	76
charge	3^-	1^-	3^+	3^+

Chapter 2 Atoms, Molecules & Ions

2.68 (a) Na_3PO_4

(b) $Zn(NO_3)_2$

(c) $Ba(BrO_3)_2$

(d) $Fe(ClO_4)_2$

(e) $Co(HCO_3)_2$

(f) $Cr(C_2H_3O_2)_3$ or $Cr(CH_3COO)_3$

(g) $K_2Cr_2O_7$

2.70 (a) HBr

(b) H_2S

(c) HNO_2

(d) carbonic acid

(e) chloric acid

(f) acetic (ethanoic) acid

2.72 (a) dinitrogen monoxide

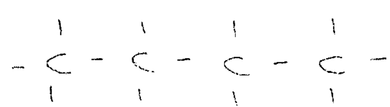
(b) nitrogen monoxide

(c) nitrogen dioxide

(d) dinitrogen pentoxide

(e) dinitrogen tetraoxide

2.75 (a) only C & H present

(b)  C_4H_{10}

molecular C_4H_{10}

empirical C_2H_5

All Alkanes

$C H_{(2c+2)}$

e.g.

$C_6 H_{(2\cdot6+2)}$

$= C_6H_{14}$

Chapter 3
Stoichiometry

3.1 A blue = A_2

B red = B

Compound = A_2B

~~4~~A_2 + ~~4~~B → ~~4~~ A_2B

$A_2 + B \rightarrow A_2B$

3.5 Blue = N

Red = O

Black = C

White = H

NH_3CH_2COO

(b) 14.01 = N

1.008 = H

12.01 = C

16.00 = O

$14.01 + (5 \times 1.008) + (2 \times 12.01) + (2 \times 16.00)$

$= 75.07$ g/mol

(c) $3 \text{ mol gly} \times \frac{75.07 \text{ g}}{1 \text{ mol gly}} = 225.2$ g/mol

(d) $\% N = \frac{14.01}{75.07} \times 100 = 18.66\%$

.8 5 molecules of O_2

8 molecules of NO

$2NO + O_2 \rightarrow 2NO_2$

$8NO \times \frac{1 O_2}{2NO} = 4 O_2$ required; 5 O_2 available = more than enough therefore NO will run out first and is limiting.

Since the mol ratio of NO and NO_2 is 2:2 or 1:1 then with 8 molec. of NO available 8 molec. of NO_2 will be produced and the reaction would stop

All NO would be gone

8 NO_2 produced

1 O_2 remaining

with % yield of 75% only 6 molec. of NO_2 would be drawn

Chapter 3
Stoichiometry cont...

3-25 (c) $7C = 84.07$

$14H = 14.11$ $\quad \frac{84.07}{130.18} \times 100 = 64.58\%$

$2O = 32.00$

130.18

3.28 molar mass = 12.01 g/mol but actually if ^{12}C then 12 g/mol

Avogadro's # of atoms in 1 mole = 6.022×10^{23}

3.32 $\frac{6.022 \times 10^{23}¢}{300 \times 10^{6}} = 2.01 \times 10^{15} \frac{¢}{\text{person}} \times \frac{1 \text{dollar}}{100¢} = \frac{\$2.01 \times 10^{13}}{\text{person}}$

About 10,000 x's larger from 10^{9} (trillion) to 10^{13}

3.36 (a) $0.0714 \text{ mol } Fe_2(SO_4)_3 \times \frac{399.91 g}{1 \text{ mol } Fe_2(SO_4)_3} = 28.6 g$

(b) ? mols NH_4^+

$8.776 g (NH_4)_2CO_3 \times \frac{1 \text{ mol } (NH_4)_2CO_3}{96.09 g} \times \frac{2 \text{ mol } NH_4^+}{1 \text{ mol } (NH_4)_2CO_3} = 0.1827 \text{ mol } NH_4^+$

(c) ? g $C_9H_8O_4$

$6.52 \times 10^{21} \text{ molec.} \times \frac{1 \text{ mol } C_9H_8O_4}{6.022 \times 10^{23} \text{ molec.}} \times \frac{180.15 g\ C_9H_8O_4}{1 \text{ mol}}$

$= 1.95 g\ C_9H_8O_4$

(d) $? \frac{g}{mol} = \frac{15.86 g}{0.05570 mol} = 284.7 g/mol$

Chapter 3 Stoichiometry

3.50 (a)

$$75.69\% C \rightarrow 75.69 g C \times \frac{1 mol}{12.01 g} = \frac{6.302}{.9694} = 6.5$$

$$8.80\% H \rightarrow 8.80 g H \frac{1 mol}{1.008 g} = \frac{8.730}{.9694} = 9$$

$$15.51\% O \rightarrow 15.51 g O \frac{1 mol}{16.00 g} = .9694 \quad \frac{}{.9694} = 1$$

$$2(C_{6.5}H_9O_1) = C_{13}H_{18}O_2$$

$$\frac{156 g}{mol} \quad \frac{18 g}{mol} \quad \frac{32 g}{mol} = 206 g/mol$$

Since the empirical formulas mass = the molecular formulas mass, the empirical and molecular formulas are the same.

(b)

$$58.55 g C \times \frac{1 mol}{12.01 g} = 4.875 mol$$

$$13.81 g H \times \frac{1 mol}{1.008 g} = 13.70 mol$$

$$27.40 g N \frac{1 mol}{14.01 g} = 1.956$$

Divide by small = 2.5, 7, 1

$$2(C_{2.5}H_7N) = C_5H_{14}N_2$$

$$\frac{60 g}{mol} \quad \frac{14 g}{mol} \quad \frac{28 g}{mol} = 102 g/mol$$

Again same empirical and molecular formula

(c)

$$59.0 g C \times \frac{1 mol}{12.01 g} = 4.913 mol$$

$$7.1 g H \times \frac{1 mol}{1.008 g} = 7.044 mol$$

$$26.2 g O \times \frac{1 mol}{16.00 g} = 1.6375 mol$$

$$7.7 g N \times \frac{1 mol}{14.01 g} = 0.5496 mol$$

Divide by small: 9, 13, 3, = 1

These #'s are somewhat messier than most problems; they usually work out much better.

Again empirical = molecular

Chapter 3 Stoichiometry

3.73 $3NaHCO_3 + H_3C_6H_5O_7 \rightarrow 3CO_2 + 3H_2O + Na_3C_6H_5O_7$

1.00 g 1.00 g

? g CO_2 formed, whichever reactant forms less is limiting

$1.00\,g\,NaHCO_3 \times \frac{1\,mol\,NaHCO_3}{84.01\,g\,NaHCO_3} \times \frac{3\,mol\,CO_2}{3\,mol\,NaHCO_3} = .0119\,mol\,CO_2 \times \frac{44.01\,g}{1\,mol\,CO_2} = 0.524\,g\,CO_2$

limiting

$1.00\,g\,H_3C_6H_5O_7 \times \frac{1\,mol\,H_3C_6H_5O_7}{192.\text{[illegible]}\,g\,H_3C_6H_5O_7} \times \frac{3\,mol\,CO_2}{1\,mol\,H_3C_6H_5O_7} = .0156\,mol\,CO_2$

g excess

$1.00\,g\,NaHCO_3 \times \frac{1\,mol}{84.01\,g\,NaHCO_3} \times \frac{1\,mol\,H_3C_6H_5O_7}{3\,mol\,NaHCO_3} \times \frac{192.12\,g}{1\,mol\,H_3C_6H_5O_7} = 0.762\,g$ used

left over = 1.000
−0.762
0.238 g

3.77 $C_6H_6 + Br_2 \rightarrow C_6H_5Br + HBr$

? TY

$\frac{30.0\,g}{78.11\,g/mol}$ $\frac{65.0\,g}{159.80\,g/mol}$

= .384 mol .4068 mol

1:1 ratio C_6H_6 runs out first and is limiting

$.384\,mol\,C_6H_6 \times \frac{1\,mol\,C_6H_5Br}{1\,mol\,C_6H_6} \times \frac{157.00\,g\,C_6H_5Br}{1\,mol\,C_6H_5Br} = 60.3\,g\,C_6H_5Br$ theoretically on paper

$\%\,yield = \frac{Actual\ Yield}{Theoretical\ Yield} \times 100 = \frac{42.3}{60.3} \times 100 = 70.14\%$

Compounds containing these ions are ***soluble*** in water...		...unless they also contain these ions, which makes them ***insoluble***
lithium	Li	
sodium	Na	
potassium	K	
rubidium	Rb	
cesium	Cs	
ammonium	NH_4	
acetate	$C_2H_3O_2$	Fe^{3+} Al^{3+} $Hg_2{}^{2+}$
chlorate	ClO_3	
chloride, bromide, iodide	Cl, Br, I	Ag^{+} $Hg_2{}^{2+}$ Pb^{2+}
perchlorate	ClO_4	
nitrate	NO_3	
sulfate	SO_4	Ca^{2+} Ba^{2+} Pb^{2+} Sr^{2+} $Hg_2{}^{2+}$

Compounds containing these ions are ***insoluble*** in water...	...unless they also contain these ions, which makes them ***soluble***
oxide	
hydroxide	all group 1 metals + Ba^{2+} Sr^{2+} Ca^{2+}
phosphate	all group 1 metals + NH_4
carbonate	all group 1 metals + NH_4
sulfite	all group 1 metals + NH_4
sulfide	all group 1 metals + NH_4
silicate	all group 1 metals

Common Ions and Their Charges

Monatomic Cations	Name
H^{+}	Hydrogen
Li^{+}	Lithium
Na^{+}	Sodium
K^{+}	Potassium
Cs^{+}	Cesium
Be^{2+}	Beryllium
Mg^{2+}	Magnesium
Ca^{2+}	Calcium
Ba^{2+}	Barium
Al^{3+}	Aluminum
Ag^{+}	Silver
Zn^{2+}	Zinc

Type II Cations	Name
Fe^{3+}	Iron (III)
Fe^{2+}	Iron (II)
Cu^{2+}	Copper (II)
Cu^{+}	Copper (I)
Co^{3+}	Cobalt (III)
Co^{2+}	Cobalt (II)
Sn^{4+}	Tin (IV)
Sn^{2+}	Tin (II)
Pb^{4+}	Lead (IV)
Pb^{2+}	Lead (II)
Hg^{2+}	Mercury (II)
Hg_2^{2+}	Mercury (I)

Monatomic Anions	Name
H^{-}	Hydride
F^{-}	Fluoride
Cl^{-}	Chloride
Br^{-}	Bromide
I^{-}	Iodide
O^{2-}	Oxide
S^{2-}	Sulfide
N^{3-}	Nitride
P^{3-}	Phosphide

Polyatomic Ions	Name
NH_4^{+}	Ammonium
NO_2^{-}	Nitrite
NO_3^{-}	Nitrate
SO_3^{2-}	Sulfite
SO_4^{2-}	Sulfate
HSO_4^{-}	Hydrogen sulfate
OH^{-}	Hydroxide
CN^{-}	Cyanide
PO_4^{3-}	Phosphate
HPO_4^{2-}	Hydrogen phosphate
$H_2PO_4^{-}$	Dihydrogen phosphate
NCS^{-}	Thiocyanate
CO_3^{2-}	Carbonate
HCO_3^{-}	Hydrogen carbonate
ClO^{-}	Hypochlorite
ClO_2^{-}	Chlorite
ClO_3^{-}	Chlorate
ClO_4^{-}	Perchlorate
$C_2H_3O_2^{-}$	Acetate
MnO_4^{-}	Permanganate
$Cr_2O_7^{2-}$	Dichromate
CrO_4^{2-}	Chromate
O_2^{2-}	Peroxide
$C_2O_4^{2-}$	Oxalate
NH_2^{-}	Amide