AP Chemistry 2019-2020

Dr. Merriman
Room 045
kmerriman@benedictinecollegeprep.org

Summer Assignment

Welcome to AP Chemistry! This course will probably be the hardest class you have had until now. You will be expected to study outside of class, to work in class, and to ask questions whenever you have them. My goal for this class is for you to leave with college credit, which for many schools means a 4 or higher on the AP exam. Your goal is to earn a 5 on the exam. I already know all of you are fully capable of achieving these scores.

Let's get started:

- **Take a look at the AP Chem periodic table- note: atomic masses are rounded to 2 numbers after the decimal point (except hydrogen and synthetic elements). We will use these numbers for all calculations next year.**
- **Complete the 7 work pages in this packet.**
- **There will be a small test covering all of these topics within the first few days of class. Take advantage of this review opportunity and start the gradebook off strong.**

Key information
(You should already know most of this.)

- Memorize the list of common polyatomic ions; know the names and formulas- I expect that you already know many of these- but please make sure you can identify all of them easily.
- Memorize the list of required metric prefixes. Expect to be able to convert between units with metric prefixes.
- Memorize the list of required solubility rules. Yeah, all four of them.
- Memorize the list of common fraction → decimal math. Be able to estimate numbers based on these common numbers. (No calculator is allowed on the multiple-choice portion, knowing these will make your life much easier, and will give you time to worry about the hard stuff.)
- Know how to identify significant figures and how to use them for addition/subtraction and multiplication/division. We will go over sigfigs with logarithms in class when we need them.

All of this information is given on the following two pages except the rules for sigfigs. If you don't remember these, do some outside research using Google, YouTube videos, etc. (or email me).

PERIODIC TABLE OF THE ELEMENTS

1 **H** 1.008																	2 **He** 4.00
3 **Li** 6.54	4 **Be** 9.01											5 **B** 10.81	6 **C** 12.01	7 **N** 14.01	8 **O** 16.00	9 **F** 19.00	10 **Ne** 20.18
11 **Na** 22.99	12 **Mg** 24.30											13 **Al** 26.98	14 **Si** 28.09	15 **P** 30.97	16 **S** 32.06	17 **Cl** 35.45	18 **Ar** 39.95
19 **K** 39.10	20 **Ca** 40.08	21 **Sc** 44.96	22 **Ti** 47.90	23 **V** 50.94	24 **Cr** 52.00	25 **Mn** 54.94	26 **Fe** 55.85	27 **Co** 58.93	28 **Ni** 58.69	29 **Cu** 63.55	30 **Zn** 65.39	31 **Ga** 69.72	32 **Ge** 72.59	33 **As** 74.92	34 **Se** 78.96	35 **Br** 79.90	36 **Kr** 83.80
37 **Rb** 85.47	38 **Sr** 87.62	39 **Y** 88.91	40 **Zr** 91.22	41 **Nb** 92.91	42 **Mo** 95.94	43 **Tc** (98)	44 **Ru** 101.1	45 **Rh** 102.91	46 **Pd** 106.42	47 **Ag** 107.87	48 **Cd** 112.41	49 **In** 114.82	50 **Sn** 118.71	51 **Sb** 121.75	52 **Te** 127.60	53 **I** 126.91	54 **Xe** 131.29
55 **Cs** 132.91	56 **Ba** 137.33	57 ***La** 138.91	72 **Hf** 178.49	73 **Ta** 180.95	74 **W** 183.85	75 **Re** 186.21	76 **Os** 190.2	77 **Ir** 192.2	78 **Pt** 195.08	79 **Au** 196.97	80 **Hg** 200.59	81 **Tl** 204.38	82 **Pb** 207.2	83 **Bi** 208.98	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** 226.02	89 **†Ac** 227.03	104 **Rf** (261)	105 **Db** (262)	106 **Sg** (266)	107 **Bh** (264)	108 **Hs** (277)	109 **Mt** (268)	110 **Ds** (271)	111 **Rg** (272)							

*Lanthanide Series	58 **Ce** 140.12	59 **Pr** 140.91	60 **Nd** 144.24	61 **Pm** (145)	62 **Sm** 150.4	63 **Eu** 151.97	64 **Gd** 157.25	65 **Tb** 158.93	66 **Dy** 162.50	67 **Ho** 164.93	68 **Er** 167.26	69 **Tm** 168.93	70 **Yb** 173.04	71 **Lu** 174.97
†Actinide Series	90 **Th** 232.04	91 **Pa** 231.04	92 U 238.03	93 **Np** (237)	94 **Pu** (244)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (257)	101 **Md** (258)	102 **No** (259)	103 **Lr** (262)

Common Polyatomic Ions

Note: Thiocyanate may also be written as SCN^- and acetate as CH_3COO^-.

Ions to Memorize	
Cations	**Name**
Ag^+	Silver
Zn^{2+}	Zinc
Hg_2^{2+}	Mercury(I)
NH_4^+	Ammonium
Anions	**Name**
NO_2^-	Nitrite
NO_3^-	Nitrate
SO_3^{2-}	Sulfite
SO_4^{2-}	Sulfate
HSO_4^-	Hydrogen sulfate (bisulfate)
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 (bicarbonate)
ClO^-	Hypochlorite
ClO_2^-	Chlorite
ClO_3^-	Chlorate
ClO_4^-	Perchlorate
BrO^-	Hypobromite
BrO_2^-	Bromite
BrO_3^-	Bromate
BrO_4^-	Perbromate
IO^-	Hypoiodite
IO_2^-	iodite
IO_3^-	iodate
IO_4^-	Periodate
$C_2H_3O_2^-$	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
BO_3^{3-}	Borate

A List of the Metric Prefixes

(All you need to know for AP Chem- there are more, Google them if you are interested)

Prefix	Symbol	Numerical	Exponential
kilo	**k**	**1,000**	**10^{3}**
no prefix means:		**1**	**10^{0}**
deci	**d**	**0.1**	**10^{-1}**
centi	**c**	**0.01**	**10^{-2}**
milli	**m**	**0.001**	**10^{-3}**
micro	**μ**	**0.000001**	**10^{-6}**
nano	**n**	**0.000000001**	**10^{-9}**

Solubility Rules for AP Chem

Solubility for other compounds will be determined based on data provided in the test.
All salts with **NAPS** are soluble.

NAPS

Nitrate (NO_3^-)
Ammonium (NH_4^+)
Potassium (K^+)
Sodium (Na^+)

Common Fractions → Decimals

No calculators are allowed on the multiple choice portion of the AP Chem Exam, and you should not attempt to fully work any long division problems due to time constraints, therefore knowing these common fractions will allow you to easily choose the correct answer based on estimates. Fractions that can be simplified are shown in simplified form.

Fraction	Decimal
1/2	0.500
1/3	0.333
2/3	0.667
1/4	0.250
3/4	0.750
1/5	0.200
2/5	0.400
3/5	0.600
4/5	0.800
1/6	0.167
5/6	0.833
1/8	0.125
3/8	0.375
5/8	0.625
7/8	0.875

Name: _____

Significant Figures and Metric Conversions

Show your work (problem 3 only), use units, and box your final answer.

1. Round each of the following numbers to four significant figures, and express the result in scientific notation:

    a. 300.235800

    _____

    b. 456,500

    _____

    c. 0.006543210

    _____

    d. 0.000957830

    _____

    e. – 0.035000

    _____

2. Carry out the following operations, and express the answers with the appropriate number of significant figures:
    a. 1.24056 + 75.80

    _____

    b. 23/67 - 75

    _____

    c. 890,000 x 112.3

    _____

    d. 78,132 / 2.50

    _____

3. Perform the following conversions: Solve each problem using dimensional analysis (bridges). Every number must have a unit and be expressed with proper significant figures. Work must be shown.

a. Convert 50.0 m to mm

_____

b. Convert 25 cm to km

_____

c. Convert 400 mm to m

_____

d. Convert 60 kg to mg

_____

e. Convert 500 nm to km

_____

Structure of the Atom and the Periodic Table

1. Complete following table, assuming each column represents a neutral atom:

Symbol	$^{39}_{19}K$				
Protons	19	25			82
Neutrons	20	30	64		
Electrons			48	56	
Mass #				137	207

Naming Inorganic Compounds

1. Give the name for each of the following ionic compounds:

    a. AlF_3 _____

    b. $Fe(OH)_2$ _____

    c. $Cu(NO_3)_2$ _____

    d. $Ba(ClO_4)_2$ _____

    e. Li_3PO_4 _____

    f. Hg_2S _____

    g. $Ca(C_2H_3O_2)_2$ _____

    h. $Cr_2(CO_3)_3$ _____

    i. K_2CrO_4 _____

    j. $(NH_4)_2SO_4$ _____

2. Write the chemical formula for each of the following compounds:

    a. copper (I) oxide

    b. potassium peroxide

    c. aluminum hydroxide

    d. zinc nitrate

    e. mercury (I) bromide

    f. iron (III) carbonate

    g. sodium hypochlorite

3. Give the name or chemical formula, as appropriate, for each of the following acids:

    a. $HBrO_3$

    b. HBr

    c. H_3PO_4

    d. hypochlorous acid

    e. iodic acid

    f. sulfurous acid

4. Give the name or chemical formula, as appropriate, for each of the following molecular substances:

    a. SF_6
    b. IF_5
    c. XeO_3
    d. dinitrogen tetroxide
    e. hydrogen cyanide
    f. tetraphosphorous hexasulfide

Atomic Masses

1. Determine the molar mass of each of the following compounds:

    a. N_2O_5
    b. $FeCO_3$
    c. disilicon hexabromide

2. Calculate the percentage by mass <u>of oxygen</u> in the following compounds:

    a. NO_2

    b. $Cr(NO_3)_3$

Balancing Equations

Balance the following equations:

a. $NaH_2PO_4 \rightarrow NaPO_3 + H_2O$

b. $Ca(OH)_2 + CO_2 \rightarrow Ca(HCO_3)_2$

c. $SrBr_2 + (NH_4)_2CO_3 \rightarrow SrCO_3 + NH_4Br$

d. $Mn_2O_3 + Al \rightarrow Al_2O_3 + Mn$

e. $S + N_2O \rightarrow SO_2 + N_2$

f. $N_2 + H_2 \rightarrow NH_3$

g. $AgNO_3 + FeCl_3 \rightarrow Fe(NO_3)_3 + AgCl$

h. $Fe_2(SO_4)_3 + KOH \rightarrow K_2SO_4 + Fe(OH)_3$

i. $Al_2(SO_4)_3 + KOH \rightarrow Al(OH)_3 + K_2SO_4$

j. $C_7H_{16} + O_2 \rightarrow CO_2 + H_2O$

Stoichiometry

Show your work and box in your final answer.

1. The fermentation of glucose, $C_6H_{12}O_6$, produces ethyl alcohol, C_2H_5OH, and CO_2 as shown here:

$$C_6H_{12}O_6\,(aq) \;\text{-->}\; 2\,C_2H_5OH(aq) + 2\,CO_2\,(g)$$

   a. How many moles of CO_2 are produced when 0.300 mol of $C_6H_{12}O_6$ fully reacts?

   b. How many grams of $C_6H_{12}O_6$ are needed to form 2.00 g of C_2H_5OH?

   c. How many molecules of CO_2 form when 2.00 g of C_2H_5OH are produced?

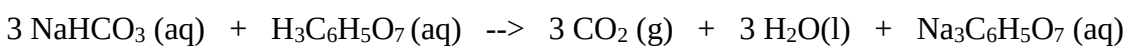
2. How many grams of $Al(OH)_3$ (molar mass = 78.0 g/mol) can be produced from the reaction of 48.6 mL of .15 M KOH with excess $Al_2(SO_4)_3$?

$$Al_2(SO_4)_3 + 6KOH \rightarrow 2Al(OH)_3 + 3K_2SO_4$$

Limiting Reactants

Show your work and box in your final answer.

1. The fizz produced when an Alka-Seltzer tablet is dissolved in water is due to the reaction between sodium bicarbonate, $NaHCO_3$, and citric acid, $H_3C_6H_5O_7$:



$$3\ NaHCO_3\ (aq) + H_3C_6H_5O_7\ (aq) \rightarrow 3\ CO_2\ (g) + 3\ H_2O(l) + Na_3C_6H_5O_7\ (aq)$$

In an experiment, 2.50 g of sodium bicarbonate and 5.00 g of citric acid are allowed to react.

a. Which reactant is the limiting reactant? You must show work to support your answer.

b. How many grams of carbon dioxide are formed?

c. How much of the excess reactant remains after the reaction is complete?