PERIODIC TABLE OF THE ELEMENTS

1 **H** 1.008																	2 **He** 4.00
3 **Li** 6.94	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)

Name: _____ Date: _____

COMMON MONATOMIC IONS

NOTE: You should commit these ions to memory by the ***first week of school***.

6B Cr^{2+} Cr^{3+} Cr^{6+}
7B Mn^{2+} Mn^{3+} Mn^{4+} Mn^{7+}
8B Fe^{2+}(ferrous) Fe^{3+}(ferric)
8B Co^{2+} Co^{3+}
8B Ni^{2+} Ni^{3+}
1B Cu^{+}(cuprous) Cu^{2+}(cupric) Ag^{+} Au^{+} Au^{3+}
2B Zn^{2+} Cd^{2+} Hg^{2+}(mercury(II), mercuric)
4A Sn^{2+}(stannous) Sn^{4+}(stannic) Pb^{2+}(plumbous) Pb^{4+}(plumbic)
5A Sb^{3+} Sb^{5+} Bi^{3+} Bi^{5+}

COMMON POLYATOMIC IONS

NOTE: You should commit these ions to memory by the ***first week of school***.

acetate, $C_2H_3O_2^-$ or CH_3COO^-	hydroxide, OH^-
ammonium, NH_4^+	hypochlorite, ClO^-
carbonate, CO_3^{2-}	hypophosphite, PO_2^{3-}
chlorate, ClO_3^-	mercury(I) (mercurous), Hg_2^{2+}
chlorite, ClO_2^-	nitrate, NO_3^-
chromate, CrO_4^{2-}	nitrite, NO_2^-
cyanide, CN^-	oxalate, $C_2O_4^{2-}$
dichromate, $Cr_2O_7^{2-}$	perchlorate, ClO_4^-
dihydrogen phosphate, $H_2PO_4^-$	permanganate, MnO_4^-
hydrogen carbonate or bicarbonate, HCO_3^-	peroxide, O_2^{2-}
hydrogen phosphate, HPO_4^{2-}	phosphate, PO_4^{3-}
hydrogen sulfate or bisulfate, HSO_4^-	sulfate, SO_4^{2-}
hydrogen sulfite or bisulfite, HSO_3^-	sulfite, SO_3^{2-}

Name: _____ Date: _____

ACTIVITY SERIES

NOTE: There is **NO** need to memorize this table.

Metals	**Nonmetals**
lithium	fluorine
potassium	chlorine
calcium	bromine
sodium	iodine
magnesium	
aluminum	
zinc	
chromium	
iron	
nickel	
tin	
lead	
HYDROGEN	
copper	
mercury	
silver	
platinum	
gold	

SOLUBILITY RULES

NOTE: You should commit these rules to memory by the ***first week of school***.

ALL COMPOUNDS IN RULES 1-4 ARE SOLUBLE IN WATER	
Rule	**Soluble EXCEPT as noted**
1. CATION	Group 1A and NH_4^+
2. ANION	NO_3^-, $C_2H_3O_2^-$, HCO_3^-, ClO_3^-, ClO_4^-
3. HALOGENS (7A)	EXCEPT when paired with Ag^+ Hg_2^{2+} Pb^{2+}
4. SULFATE (SO_4^{2-})	EXCEPT when paired with Ag^+ Hg_2^{2+} Pb^{2+} Ca^{2+} Ba^{2+} Sr^{2+}
ALL OTHER COMPOUNDS ARE INSOLUBLE	

Name: _____ Date: _____

AP® Chemistry
Summer Assignments

Instructor: Carla Krieger
E-mail: ckrieger@basdschools.org

1. Course Description

AP Chemistry meets five days per week for one 70-minute period daily for 27 weeks. The curriculum is designed to prepare students to take the AP Chemistry Exam. This course is a rigorous, math- and laboratory-based course that covers concepts, mathematical problems, and experiments equivalent to two semesters of a college-level inorganic chemistry course. Problem-solving, critical thinking, and written expression are emphasized in lecture as well as laboratory. Bear in mind that AP Chemistry is a college class with college-level expectations for behavior, participation, workload, and effort. Therefore, you should expect to spend 1 or 2 hours on homework each night.

2. Course Topics

• Chemistry Basics, Stoichiometry, & Gases	Chap 1, 2, 3, & 10
• Aqueous Reactions	Chap 4
• Thermochemistry	Chap 5
• Electrons & the Periodic Table	Chap 6 & 7
• Bonding & Molecular Geometry	Chap 8 & 9
• Intermolecular Forces & Solutions	Chap 11 & 13
• Kinetics & Chemical Equilibrium	Chap 14 & 15
• Acid/Base & Aqueous Equilibria	Chap 16 & 17
• Thermodynamics & Electrochemistry	Chap 19 & 20
• Organic	Chap 25

3. Materials

- Brown & LeMay. *Chemistry: The Central Science*, 13th ed.
- Lab notebook (supplied by FHS)
- Scientific calculator
- AP Exam review book for the ***revised*** exam

4. Laboratory Component

A minimum of one full-period experiment occurs weekly with shorter experiments taking place as time permits. On the AP Exam, you will be asked questions about specific laboratory procedures, data, calculations, conclusions, and sources of error. Furthermore, some institutions require students to produce a record of the laboratory work completed in AP Chemistry before granting credit, placement, or both. Therefore, you will be required to submit a complete report for each AP required experiment. All of your lab reports will be kept in a bound laboratory notebook that will be submitted each time that a lab report is due.

5. Course Website

Announcements, a course calendar, and materials for each unit are available at our class website: https://sites.google.com/a/basdschools.org/ap-chemistry/. Links to unit materials will be sent to your **basdschools address**. Therefore, please be sure to check your basdschools email regularly over the

summer. Once the course begins, you will be expected to check your email and the website Announcements page **daily**.

6. Summer Review Work

Because this is a second-year course, you are expected to have a thorough understanding of:

- The classification and properties of matter
- Significant figures, SI units, and dimensional analysis
- Nomenclature and formulas of compounds
- The mole and stoichiometry
- Electron configurations
- Electronegativity
- Ionic, metallic, and covalent bonding
- Molecular geometry and polarity
- Gas laws

Directions: If you have not received a copy of this document, print out pages 6 through 15 and complete each of the problems. Be sure to show work wherever indicated and use appropriate units and sig figs in your answers. Use the tables on pages 1-3 to complete this assignment. Round all atomic masses on the accompanying periodic table (see page 1) to the tenths for all elements EXCEPT H, He, Li, and Be; masses of elements 1 through 4 should be rounded to the hundreths. Compare your answers to the provided answer key and note any questions you have. Your questions on pages 6-15 should be ready for review during the **first week of school**. You will be tested on this material shortly after it is reviewed in class.

Name: _____ Date: _____

AP Chemistry Required Summer Assignments

SECTION ONE

1) Indicate the correct number of significant figures for each of the following.

a.	4900	_____	e.	450.230	_____
b.	0.00340	_____	f.	1.67×10^{-5}	_____
c.	12.000	_____	g.	3008	_____
d.	20.	_____	h.	0.000004	_____

2) Round the following numbers to three significant figures.

a.	2341	_____	d.	0.3427	_____
b.	129,840	_____	e.	10.156	_____
c.	9.865	_____	f.	81820	_____

3) Calculate each of the following with correct significant figures.

a.	45.980 + 0.003458	_____	c.	395.00 / 24	_____
b.	12 – 9.783	_____	d.	$(9.00)(8.4 \times 10^{2})$	_____

4) Perform the following conversions using dimensional analysis.

a. 940 km to mm

b. 23.4 g to kg

c. 19.3 mL to L

d. 329.5 mm to ft

5) The volume of a balloon is found to be 250 mL. How many cubic meters (m^3) does the balloon contain?

Name: _____ Date: _____

6) An experiment requires 75.0 g of ethyl alcohol (density = 0.790 g/mL). What volume of the alcohol in liters will be required?

7) Calculate the density (in g/cm^3) of a rectangular solid that has a mass of 0.03416 kg and measures 2.50 cm by 1.80 cm by 3.00 cm.

8) A champion runner is determined to have an average speed of 3.2 m/s. What is his rate of speed in miles per hour?

9) Determine the number of protons, neutrons, and electrons for each of the following.

a. ^{35}Cl _____ c. $^{65}Cu^{2+}$ _____

b. ^{222}Rn _____ d. $^{31}P^{3-}$ _____

10) Iridium is composed essentially of two isotopes: ^{191}Ir and ^{193}Ir. The average atomic mass of an iridium atom is 192.217 amu. Determine the percent abundance of each of these isotopes in a naturally occurring sample. The mass of a ^{191}Ir atom is 190.961 amu, while the mass of a ^{193}Ir atom is 192.963 amu.

11) Draw the orbital diagram for ground-state arsenic.

12) Write the electron configuration of each of the following in *spdf* notation.

a. Nickel

b. Tellurium

c. Copper

d. Pb^{4+}

Name: _____ Date: _____

13) Write the electron configuration of each of the following in kernel (noble gas) notation.

a. Br

c. Cr

b. I^-

d. Rn

14) Describe the Modern Periodic Law.

15) State the formula (including number and charge) of the ion that each of the following elements forms.

a. Nitrogen _____
b. Magnesium _____
c. Potassium _____
d. Bromine _____
e. Xenon _____
f. Aluminum _____

16) What is ionization energy? Describe the trend that is seen going across a period and down a group. Be sure to explain why this trend occurs for each as well.

17) Which element is the most electronegative? Explain how electronegativity plays a role in the compounds that are formed by this element.

18) Write the formula for the following compounds.

a. Barium sulfate _____
b. Phosphoric acid _____
c. Magnesium nitride _____
d. Tin(II) oxide _____
e. Nitrogen trifluoride _____
f. Iron(III) hydroxide _____
g. Lithium oxalate _____
h. Hydrobromic acid _____
i. Dichlorine monoxide _____
j. Ammonium nitrate _____
k. Chlorous acid _____
l. Lead(II) carbonate _____

19) Write the name for each of the following compounds.

a. P_4O_{10} _____
b. AgBr _____
c. $HC_2H_3O_2$ _____
d. Sr_3P_2 _____
e. PbO_2 _____
f. $Cu(NO_3)_2 \cdot 3H_2O$ _____
g. H_3PO_3 _____
h. PCl_5 _____
i. HNO_2 _____
j. NaCN _____
k. FeI_3 _____
l. HF _____

Name: _____ Date: _____

AP Chemistry Required Summer Assignments

SECTION TWO

1) Draw the Lewis dot structures for each ion pair and show the transfer of electrons using arrows. Be sure to include the charge on each ion after the transfer and write the formula unit.
   a. Aluminum and sulfur

   b. Barium and bromine

2) Differentiate between ionic and covalent compounds. Give TWO properties for each type.

3) Draw Lewis dot structures for each of the following compounds.
   a. SCl_6

   b. C_2H_4

   c. HCN

   d. $CH_2(OH)CH_2(OH)$

Name: _____ Date: _____

4) Give an example of a polar molecule and explain why it exhibits polarity.

5) Write the complete, balanced equation and give the reaction type for each of the following.

a. $Zn(s) + Cu(NO_3)_2(aq) \rightarrow$

b. $Ag(s) + Cl_2(g) \rightarrow$

c. $Al_2(SO_4)_3(aq) + NaOH(aq) \rightarrow$

d. $C_6H_{14}(g) + O_2(g) \rightarrow$

e. gold(III) oxide (s) →

f. sodium(s) + bromine(l) →

g. hydrochloric acid(aq) + tin(IV) hydroxide(aq) →

h. potassium(s) + water(l) →

6) Calculate the percent composition of nitrogen in ammonium thiocyanate, NH_4SCN.

Name: _____ Date: _____

7) Determine the number of moles of each of the following.

a. 324.8 g of $SrCl_2$

b. 2.4×10^{24} atoms of Mn

c. 12.50 L of $NH_3(g)$ at STP

d. 9.52 g of $Ba(NO_3)_2$

8) An unknown compound found in some foods was found to contain 64.7% carbon, 5.9% hydrogen, and 13.7% nitrogen with the rest being oxygen. Find the empirical formula of this compound.

9) Tetrachloroethene (C_2Cl_4), often called perchloroethylene (perc), is a colorless liquid used in dry cleaning. The compound can be formed in several steps from the reaction of dichloroethane, chlorine gas, and oxygen gas as seen below:

$$8\ C_2H_4Cl_2(l) + 6\ Cl_2(g) + 7\ O_2(g) \rightarrow 4\ C_2HCl_3(l) + 4\ C_2Cl_4(l) + 14\ H_2O(l)$$

a. How many grams of perc will be produced when 25.0 g of dichloroethane, 15.0 g of chlorine gas, and 10.0 g of oxygen gas react?

b. What is the mass of each excess reagent that remains?

c. How many kilograms of the other two products are also formed when this reaction is performed?

d. If only 8.46 g of perc are produced, what is the percent yield of this reaction?

10) The thermite reaction (see below) has been used to weld railroad tracks. How many grams of aluminum would be needed to produce 15.0 grams of iron?

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

11) Silver nitrate reacts with iron (III) chloride. In a particular experiment, it was planned to mix a solution containing 25.0 g of silver nitrate with another solution containing 45.0 grams of iron (III) chloride. What is the maximum amount of solid that could be formed?

12) Ammonia gas and hydrogen chloride gas combine to make ammonium chloride. What volume of ammonia is needed to react with 47.7 liters of hydrogen chloride at STP?

13) Sea water contains roughly 28.0 grams of NaCl per liter. What is the molarity of sea water?

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14) When a reddish solution of cobalt (II) chloride is added to a white solution of calcium hydroxide, a blue precipitate forms. Write the overall net ionic equation for this reaction and identify any spectator ions.

15) Using the solubility rules, indicate whether each of the following would be soluble or insoluble in water.

a. Barium sulfate _____ g. Potassium acetate _____

b. Magnesium oxide _____ h. Ammonium hydroxide _____

16) A solution of 235 mL of 0.530 M lead (II) nitrate is mixed with 14.8 g of potassium iodide. Assuming the volume change from adding the solid to the solution is negligible, how many grams of the precipitate will be formed?

17) A sample of deadly chlorine gas has a volume of 80.0 liters and a pressure of 900.0 mm of Hg. Assuming the temperature is 20.0°C, find the number of molecules of gas in this sample.

18) An airtight container with a volume of 4.25×10^4 L, an internal pressure of 1.00 atm, and an internal temperature of 15.00°C is washed off the deck of a ship and sinks to a depth where the pressure is 175 atm and the temperature is 3.00°C. What will the volume of the gas inside be when the container breaks under the pressure at this depth?

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AP Chemistry Required Summer Assignments

SECTION THREE

1) On a cold, snowy February day, Northampton County got 7.460 inches of snow. If the county covers about 370.0 square miles and the average density of the freshly fallen snow was 161 kg/m^3, how many total snowflakes needed to fall in order to generate this much snow across the county? Each snowflake has a mass of 2.97 x 10^3 μg (1 gram = 10^6 micrograms).

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

3) Write the complete, balanced equation for each of the following reactions.
   a. Sodium metal is added to water.

   b. A solution of tin (II) chloride is added to a solution of iron (III) sulfate.

   c. Chlorine gas is bubbled into a solution of potassium iodide.

   d. 70% isopropyl alcohol (C_3H_7OH) is burned

4) The hormone, thyroxine is secreted by the thyroid gland, and has the formula: $C_{15}H_{17}NO_4I_4$. How many milligrams of iodine can be extracted from 15.0 grams of thyroxine?

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5) Caffeine has the following percent composition: carbon 49.48%, hydrogen 5.19%, oxygen 16.48% and nitrogen 28.85%. Its molecular weight is 194.19 g/mol. What is its molecular formula?

6) Nitroglycerin, $C_3H_5(ONO_2)_3$, was invented in 1846 by an Italian chemist named Ascanio Sobrero. This compound contains both an oxidant and a fuel. When it detonates, it decomposes to form carbon dioxide, water, nitrogen, and oxygen, all in a gaseous state. If 1.135 kg of nitroglycerin detonates, how many TOTAL liters of gas at STP are produced?

7) The first step in the Ostwald process for manufacturing nitric acid is the reaction of ammonia with oxygen to produce nitrogen monoxide and water. If the reaction consumes 595 g of ammonia, determine each of the following:

   a. What is the minimum amount of oxygen (in liters) needed for this reaction at STP?

   b. Assuming the reaction has a 90.3% yield, how many grams of water will form?

8) On a warm day, an amusement park balloon is filled with 47.8 g He. The temperature is 33.0°C and the pressure in the balloon is 2.25 atm. Calculate the volume of the balloon in milliliters.