Advanced Placement Chemistry Summer Assignment
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Dear AP Chemistry Candidate:

Congratulations on your choice of AP Chemistry for the upcoming year. I am very excited to be your AP Chemistry teacher. The material to be covered in this class is equivalent to slightly more than the first year of general college chemistry (inorganic chemistry and an introduction to organic chemistry). Thus, the class will be conducted similar to a college class. The majority of the time is spent in lecture. You must read ahead and be prepared for each class. We have a lot of material to cover in preparation for the AP Chemistry Exam. Regardless of whether you plan to actually take the exam, the class is geared specifically toward preparing you to do so.

The only source of grades will be major tests, quizzes, homework and labs. You are expected to complete all homework assignments on time. We will go over specific problems at the beginning of each class to ensure understanding of major concepts. As with any other AP course, you will be expected to complete a considerable amount of independent study time. AP guidelines specify a *minimum* of five hours of work outside the classroom each week. You can expect to have written homework nearly every night. Remember this is a double-period class. If you are prone to being absent frequently, you will have a difficult time keeping up, as you will miss two classes on most days when you are absent. It will be in your best interest to keep up with assignments and work ahead when possible.

To help ensure that you are ready for AP Chemistry, I have prepared the Summer Assignment. You will find in specific terms, concepts and problems that you must understand to before beginning the course. I hope you took good notes and completed and retained all your work from first-year chemistry, as it will be helpful when completing the assignment. The first part of the packet is merely a general outline that contains information you should know. The second part contains the actual written assignment. The chapter numbers correspond to the chapters in a first-year chemistry text, *Modern Chemistry*. The AP text, *Chemistry: Principals and Reactions*, will be used in our class. Both the first and second parts of the packets have been divided into two sections. The first section of each part pertains to material that will be covered using only the Summer Assignment. It will be reviewed and tested at the end of the first school week. The second section in each part pertains to material that will be taught *again* at the AP level. However, some prior knowledge will be both assumed and helpful. This material is included for those who want or need to review in more depth.

Good luck. I hope you have a great summer. Send me an email if you get have a question or need help. I also suggest that you work with classmates if possible. Someone may have notes or work that you are missing. Please try to avoid getting together for just "copying" work. You should really try to work and understand each question and problem. If you do not, you are only making it harder for yourself next year. I am willing to offer a day before school starts to provide extra help. The session will be towards the end of July or early August. I will post a specific time and room number, once I have heard a request from anyone by email. The help session is optional. However, remember that we will be covering all of the review material within the first school week.

Sincerely,
Bryan Rosenstiel
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Part I: General Outline of Information You Should Know

**General:* *elements and their symbols, list of common monatomic and polyatomic ions (name, symbol, charge), significant figure rules, arrangement of the periodic table*

Chapter 1 – Matter and Change

1. defns: mixture, heterogeneous mixture, homogeneous mixture, solution, pure substance, compound, mass, matter, atom, element, physical property/change, chemical property/change
2. group (family), period

Chapter 2 – Measurements and Calculations

1. SI base units/unit abbreviations for length, mass, time, temperature, amount of a substance
2. defns: direct proportion, inverse proportion, accuracy, precision, percent error
3. metric prefixes and their relation to the base unit (i.e. conversion factors)
   T, G, M, k, h, da / d, c, m, μ, n, p
4. formula for density $d = m/v$ formula for distance $d = r \times t$
5. significant figure rules (including rounding, adding/subtracting, multiplying/dividing) and scientific notation

Chapter 3 – Atoms: The Building Blocks of Matter

1. defns: law of multiple proportions, law of conservation of mass, law of definite proportions, isotope
2. parts of the atom (electron, proton, neutron, nucleus)
3. atomic number, mass number – which is which on the periodic table; what information each gives
4. using molar mass as a conversion factor between mass and moles
5. Avogadro's number and its relation to the mole 6.022×10^{23} particles/mole
6. calculation of average atomic mass

Chapter 7 – Chemical Formulas and Chemical Compounds

1. common monatomic and polyatomic ions (name, symbol, charge)
2. assigning oxidation numbers to elements in a compound
3. writing neutral chemical compound formulas
4. naming of ionic, covalent and acid compounds
5. determining empirical, molecular formulas, percent composition

Chapter 9 – Stoichiometry

1. mol-mol, mol-mass, mass-mol, mass-mass conversion problems
2. determining mole ratios from balanced equations
3. determining limiting reactants
4. calculating percent yield

* *The next chapters include material that will be taught again at the AP level. This section is not required. However, you may wish to review this material as prior knowledge will be assumed and helpful.*

Chapter 5 – The Periodic Law

1. general arrangement of the periodic table
2. group and period trends for atomic radius, ionization energy, electron affinity, ionic radius, electronegativity

Chapter 6 – Chemical Bonding

1. ionic vs. covalent (molecular) polar vs. nonpolar
2. Lewis structures and ionic electron-dot formulas
3. VSEPR Theory – drawing/naming structures (electron-pair and molecular geometries)
4. intermolecular types of bonding

Chapter 8 – Chemical Equations and Reactions

1. writing/predicting equations (both formula and word)
2. using the activity series
3. classifying reactions according to the four main types

Part II: Question/Problem Assignment

Chapter 1 – Matter and Change

1. Define: mixture, heterogeneous mixture, homogeneous mixture, solution, pure substance, compound, mass, matter, atom, element, physical property/change, chemical property/change
2. Define: group (family), period

Chapter 2 – Measurements and Calculations

1. Define: direct proportion, inverse proportion, accuracy, precision, percent error
2. List: SI base units/abbreviations for length, mass, time, temperature, amount of a substance
3. Determine the number of significant figures in each of the following: (a) 65.4; (b) 0.0068; (c) 0.0070; (d) 36.00; (e) 100.6040; (f) 340.00
4. Convert 48 cg into mg, dg, g, kg and μg using conversion factors/dimensional analysis
5. What distance will and automobile cover in five days if it travels at a speed of 88 km/hr for 10 hours each day? What type of proportional relationship exists between speed and time?
6. What is the density of a substance with a mass of 240.00 g and a volume of 60.0 cm^3? What type of proportional relationship exists between mass and volume?
7. Perform the following calculations:
   (a) 0.067 mL + 1.01 mL + 2.5 mL
   (b) 0.08421 g / 0.640 mL
   (c) $7.43 \times 10^4 - 5.09 \times 10^7$
   (d) $(6.02 \times 10^{23})(3.0 \times 10^{-11})$
8. Put each of the following in scientific notation. Retain the same number of significant figures. (a) 93000000; (b) 0.000082; (c) 6500×10^7; (d) 0.097×10^{-4}

Chapter 3 – Atoms: The Building Blocks of Matter

1. Define: law of multiple proportions, law of conservation of mass, law of definite proportions, isotope
2. List the parts of the atom and indicate the charge and location of each
3. Differentiate between atomic number and mass number
4. Complete the following table:

Symbol	Atomic #	Mass #	# Protons	# Electrons	# Neutrons
He					
Be					
	16	32			
	14				14
		65			35
				18	22

5. Perform the following conversions using molar mass:
   (a)4.25 mol Li → g
   (b)3.25×10^5 g Pb → mol
   (c)3.011×10^{23} atoms Mg → g
6. Find the average atomic mass of an element made up of the following percentage of isotopes: Ar-36 (35.798 amu, 0.337 %), Ar-38 (37.963 amu, 0.063 %), Ar-40 (39.962 amu, 99.600 %)

Chapter 7 – Chemical Formulas and Chemical Compounds

1. Write the formula for the following compounds: (a) sodium fluoride; (b) copper (I) sulfide; (c) ammonium chloride; (d) carbon tetrabromide; (e) diphosphorus pentoxide; (f) chromium (II) phosphate; (g) sodium acetate; (h) phosphoric acid; (i) hydrochloric acid (j) sulfuric acid; (k) sulfurous acid; (l) carbonic acid

2. Name the following compounds: (a) MgO; (b) $AgNO_3$; (c) $Sn(NO_3)_2$; (d) $Fe(OH)_3$; (e) HNO_3; (f) HF; (g) PBr_3; (h) SO_2; (i) P_4O_{10}
3. Find the empirical formula of a compound made of 52.20 % C, 13.00 % H, 34.80 % O.
4. An oxide of phosphorus is found to contain 43.5 % P and 56.5 % O. Its formula mass is 284.0 amu. Find its molecular formula.
5. Determine the percent composition of $Mg(OH)_2$.

Chapter 9 – Stoichiometry

1. Copper (II) reacts with oxygen to produce copper (II) oxide according to the following equation.

$$Cu + O_2 \rightarrow CuO$$

How many grams of copper (II) oxide can be made from 1000. g Cu?

2. 16.2 g of magnesium are combined with 12.0 g of water to produce magnesium hydroxide and hydrogen according to the following equation

$$Mg + H_2O \rightarrow Mg(OH)_2 + H_2$$

How many grams of magnesium hydroxide are produced? (Hint: limiting reactant involved)

3. 10.4 g of sulfuric acid reacts with excess aluminum to produce 5.25 g of aluminum sulfate according to the following equation

$$H_2SO_4 + Al \rightarrow Al_2(SO_4)_3 + H_2$$

What is the percent yield of aluminum sulfate?

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Chapter 5 – The Periodic Law

1. Define: noble gases, actinides, lanthanides, alkali metals, alkaline earth metals, halogens, transition elements, valence electrons
2. Define: electron affinity, electronegativity, cation, anion, ionization energy
3. Arrange the following from smallest to largest atomic radus: Na, P, K
4. Arrange the following from smallest to largest ionization energy: Li, O, C, K, Ne, F
5. Arrange the following from smallest to largest electron affinity: C, O, Li, Na, Rb, Ne, F
6. Which element has the highest electronegativity in each group: (a) Li, C, O (b) Mg, Ba, C
7. Determine the charge of the ion most likely to be formed from: (a) Li; (b) O; (c) Br; (d) Al

Chapter 6 – Chemical Bonding

1. Differentiate between ionic and covalent bonds
2. Differentiate between polar- and nonpolar-covalent bonds
3. If the compound is covalent, or if it is a polyatomic ion, give the Lewis structure, the electron geometry and the molecular geometry. If the compound is ionic, use electron dot symbols to demonstrate the formation of ionic bonds. (a) NH_3; (b) H_2S; (c) SiF_4; (d) CH_2O; (e) SO_4^{2-}; (f) NO_3^-; (g) PCl_5, where P is an exception to the octet rule; (h) SF_6, where S is an exception; (i) NaCl; (j) $MgBr_2$; (k) BCl_3, where B is an exception; (l) CaO; (m) ONCl; (n) Al_2S_3; (o) ClO_2^-
4. Define: dipole-dipole force, hydrogen bonding, London-dispersion force

Chapter 8 – Chemical Equations and Reactions

1. For each of the following, balance the equation and indicate the type of reaction:
   (a) $AgNO_3 + CuCl_2 \rightarrow AgCl + Cu(NO_3)_2$
   (b) $KClO_3 \rightarrow KCl + O_2$
2. For each of the following, write the word equation and balanced formula equation. If no reaction occurs, write NR.
   (a) reaction between sodium hydroxide and sulfuric acid
   (b) addition of zinc and water
   (c) decomposition of magnesium hydroxide
   (d) reaction between barium sulfate and copper (II) hydroxide

3. For each of the following, complete and balance the equation, write the word equation, and indicate the reaction type. If no reaction occurs, write NR.
   (a) $Au + O_2 \rightarrow$
   (b) $Na + HCl \rightarrow$
   (c) $Pb(NO_3)_2 + KI \rightarrow$
   (d) $Ba(ClO_3)_2 \rightarrow$

Common Ions Listed by Charge

Positive Ions

1+

hydrogen	H^+
hydronium	H_3O^+
lithium	Li^+
sodium	Na^+
potassium	K^+
rubidium	Rb^+
cesium	Cs^+
silver	Ag^+
ammonium	NH_4^+
copper(I) cuprous	Cu^+
gold(I) aurous	Au^+

2+

beryllium	Be^{2+}
magnesium	Mg^{2+}
calcium	Ca^{2+}
strontium	Sr^{2+}
barium	Ba^{2+}
cadmium	Cd^{2+}
chromium(II) chromous	Cr^{2+}
cobalt(II) cobaltous	Co^{2+}
copper(II) cupric	Cu^{2+}
iron(II) ferrous	Fe^{2+}
lead (II) plumbous	Pb^{2+}
mercury(I) mercurous	Hg_2^{2+}
mercury(II) mercuric	Hg^{2+}
nickel(II) nickelous	Ni^{2+}
tin(II) stannous	Sn^{2+}
manganese(II) manganous	Mn^{2+}
zinc	Zn^{2+}

3+

aluminum	Al^{3+}
arsenic(III)	As^{3+}
bismuth(III)	Bi^{3+}
scandium	Sc^{3+}
antimony(III) antimonious	Sb^{3+}
cobalt(III) cobaltic	Co^{3+}
chromium(III) chromic	Cr^{3+}
gold(III) auric	Au^{3+}
iron(III) ferric	Fe^{3+}
nickel(III) nickelic	Ni^{3+}

4+

tin(IV) stannic	Sn^{4+}
lead(IV) plumbic	Pb^{4+}
manganese(IV) manganic	Mn^{4+}

5+

antimony(V) antimonic	Sb^{5+}
arsenic(V)	As^{5+}
bismuth(V)	Bi^{5+}

Negative Ions

1-

fluoride	F^-
chloride	Cl^-
bromide	Br^-
iodide	I^-
hydride	H^-
hypochlorite	ClO^-
chlorite	ClO_2^-
chlorate	ClO_3^-
perchlorate	ClO_4^-
bromate	BrO_3^-
iodate	IO_3^-
nitrate	NO_3^-
nitrite	NO_2^-
permanganate	MnO_4^-
cyanide	CN^-
hydroxide	OH^-
hydrogen sulfide	HS^-
hydrogen carbonate bicarbonate	HCO_3^-
hydrogen sulfate bisulfate	HSO_4^-
hydrogen sulfite	HSO_3^-
dihydrogen phosphate	$H_2PO_4^-$
acetate	$C_2H_3O_2^-$
cyanate	OCN^-
thiocyanate	SCN^-

2-

sulfide	S^{2-}
oxide	O^{2-}
peroxide	O_2^{2-}
carbonate	CO_3^{2-}
carbide	C_2^{2-}
chromate	CrO_4^{2-}
dichromate	$Cr_2O_7^{2-}$
oxalate	$C_2O_4^{2-}$
sulfate	SO_4^{2-}
sulfite	SO_3^{2-}
hydrogen phosphate	HPO_4^{2-}
hydrogen phosphite	HPO_3^{2-}
thiosulfate	$S_2O_3^{2-}$

3-

nitride	N^{3-}
phosphide	P^{3-}
arsenate	AsO_4^{3-}
arsenite	AsO_3^{3-}
borate	BO_3^{3-}
phosphate	PO_4^{3-}
phosphite	PO_3^{3-}
ferricyanide	$Fe(CN)_6^{3-}$

4-

ferrocyanide	$Fe(CN)_6^{4-}$
carbide	C^{4-}