Mrs. Hadden's Summer Assignment

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Welcome to Advance Placement Chemistry! The AP Chemistry class is a year-long course that provides students with an opportunity to develop a conceptual framework for chemistry, emphasizing practical applications and critical thinking. This is a college level course, so it is expected that the students come to class prepared and motivated to work in a fast-paced environment. I am excited for the year to come!

Foundation Knowledge – **Due Friday, Aug 13th** .

This review consists of important chemistry material you'll need to know for the first unit. There will be a quiz on this foundational knowledge which will be on **Friday, August 13th.** This is pre-requisite material that you should be able to answer *without assistance* if you have previously taken chemistry. If this is your first chemistry class, make sure to review or learn the material on your own. I am always available for questions! In fact, my literal job is to help you, so don't be shy!

You are to answer all questions on a separate sheet of paper. Attach this sheet to the front of your work for full credit. This **must be handwritten and not typed.** This document should be kept in your chemistry binder for you to refer back to later!

Vocab:

Define in your own words:

A. Neutrons
B. Protons
C. Electrons
D. Atomic number
E. Atomic weight
F. Isotope
G. Valence
H. Empirical formula
I. Molecular formula
J. Covalent bond
K. Ionic bond
L. Metallic bond
M. Polar
N. Nonpolar
O. Cations
P. Anions
Q. Oxidation
R. Hydrogen bond
S. London-dispersion force
T. Dipole-dipole
U. Molar mass
V. Exothermic
W. Endothermic

Study Questions:

1. How do elements differ from compounds?
2. Name and define the subatomic particles that are part of an atom. How do they differ from each other? How do these difference contribute to properties of an atom?
3. What is an atom? Give an example.
4. What is the difference between atomic number and atomic weight?
5. Determine the molar mass and the electron configuration for:

a. Carbon tetrachloride

b. Carbon dioxide

c. Phosphorus tricholride

d. Hydrobromic acid

e. $C_6H_{12}O_6$

f. Magnesium phosphate

g. Ammonium permanganate

6. Where is the difference between atomic mass and molar mass?

7. What is the difference between ^{12}C and ^{14}C?

8. What is a valence electron? Why are they important? How can one determine the valence electron of an element?

9. What is the difference between an ionic, covalent and a metallic bond?

10. List three characteristics of each type of bond from question 9.

Use this list as a starting point. It will make your life easier if you can commit the following information to memory. Please note that for this section of the assignment you **don't actually have to turn anything from this section in at the beginning of the year.**

Memorize (Use flash cards or Quizlet to aid in memorizing. Please find list of information attached to this assignment):

a. Elements(common)
b. Common ions & their charges
c. Polyatomics ions (there are more than what you *should* have already learned)
d. Diatomics
e. Metric prefixes and conversion factors
f. Other conversion factors (temperature, energy, moles etc.)
g. Naming compounds (nomenclature)

As always, if you have a question, please do not hesitate to contact me!

My email is 194310@hcps.net

Thanks,

Mrs. Brooke Hadden

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AP CHEMISTRY To Memorize List

a. Elements (common)

The Periodic Table (P.T) given on the AP exam does NOT have element names written out, only symbols are used. Therefore, you must be familiar with their names in order to use the periodic table effectively. Below is a list of common elements you are expected to know the name and symbol of (spelling counts).

H	He	Li	Be	B	C	N	O	F	Ne
Na	Mg	Al	Si	P	S	Cl	Ar	K	Ca
Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn
As	Se	Br	Kr	Rb	Sr	Y	Zr	Mo	Pd
Ag	Cd	Sn	Sb	Te	I	Xe	Cs	Ba	La
W	Pt	Au	Hg	Pb	Bi	Po	At	Rn	Fr
U	Pu								

b. Common ions & their charges

A mastery of the common ions, their formulas and their charges, is essential to success in

AP Chemistry. You are expected to know all of these ions on the first day of class. You will always be allowed a periodic table, which makes identifying the ions on the left "automatic." For tips on learning these ions, keep reading! ☺

1. **Ions easily found on the P.T.—**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.
    1. All Group 1 Elements (alkali metals) lose one electron to form an ion with a 1+ charge (Hydrogen can sometimes gain or lose…pesky hydrogen!)
    2. All Group 2 Elements (alkaline earth metals) lose two electrons to form an ion with a 2+ charge
    3. Group 13 metals like aluminum lose three electrons to form an ion with a 3+ charge
    4. All Group 17 Elements (halogens) gain one electron to form an ion with a 1- charge
    5. All Group 16 nonmetals gain two electrons to form an ion with a 2- charge
    6. All Group 15 nonmetals gain three electrons to form an ion with a 3- charge
2. These ions can be organized into two groups (cations and anions)
    1. Notice that cations keep their name (sodium ion, calcium ion) while anions get an "-ide" ending (chloride ion, oxide ion).

Ions easily found on the P.T.			
Cations		**Anions**	
Cations	**Name**	**Anions**	**Name**
H^+	Hydrogen	H^-	Hydride
Li^+	Lithium	F^-	Fluoride
Na^+	Sodium	Cl^-	Chloride
K^+	Potassium	Br^-	Bromide
Rb^+	Rubidium	I^-	Iodide
Cs^+	Cesium	O^{2-}	Oxide
Be^{2+}	Beryllium	S^{2-}	Sulfide
Mg^{2+}	Magnesium	Se^{2-}	Selenide
Ca^{2+}	Calcium	N^{3-}	Nitride
Ba^{2+}	Barium	P^{3-}	Phosphide
Sr^{2+}	Strontium	As^{3-}	Arsenide
Al^{3+}	Aluminum		

3. **Ions found on the P.T. but don't follow a pattern—**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 cation.

    1. Note there are a few exceptions to these transition metals (silver and zinc) because in nature the only ever form those particular charges so no need to specific with a roman numeral.

Ions found on the P.T. but don't follow a pattern			
Cations	**Name**	**Cations**	**Name**
Fe^{2+}	Iron (II)	Sn^{2+}	Tin (II)
Fe^{3+}	Iron (III)	Sn^{4+}	Tin (IV)
Cu^{+}	Copper (I)	Pb^{2+}	Lead (II)
Cu^{2+}	Copper (II)	Pb^{4+}	Lead (IV)
Co^{2+}	Cobalt (II)	Hg_2^{+2}	Mercury (I)****dimeric**
Co^{3+}	Cobalt (III)	Hg^{2+}	Mercury (II)
Ag^{+}	Silver ***no roman number needed b/c only charge silver has	Zn^{2+}	Zinc ***no roman number needed b/c only charge zinc has

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c. Polyatomic ions *(see table on the next page)*

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.

1. **"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^{-})
2. **If you add a hydrogen to the front, it changes the charge by +1.**
    1. If you know that a sulfate 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… HSO_4^{-}

EXAMPLE:

PO_4^{3-} → HPO_4^{2-} → $H_2PO_4^{-}$

phosphate→ hydrogen phosphate → dihydrogen phosphate

3. **Series with the prefixes hypo and hyper…**
    1. Learn the hypochlorite chlorite chlorate perchlorate series, and you also know the series containing iodite/iodate as well as bromite/bromate.
    2. The relationship between the "ite" and "ate" ion is predictable, as always. Learn one and you know the other.
    3. The prefix "hypo" means "under" or "too little" (think "hypodermic", "hypothermic" or "hypoglycemia")
        - Hypochlorite is "under" chlorite, meaning it has one less oxygen
    4. 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.

EXAMPLE: Notice how this sequence increases in oxygen while retaining the same charge:

ClO^{-} → ClO_2^{-} → ClO_3^{-} → ClO_4-

hypochlorite→ chlorite → chlorate → perchlorate

Polyatomic Ions			
-1	**Name**	**-2 or -3**	**Name**
HSO_4^-	Hydrogen sulfate (bisulfate)	SO_3^{2-}	Sulfite
NO_2^-	Nitrite	SO_4^{2-}	Sulfate
NO_3^-	Nitrate	$S_2O_3^{2-}$	Thiosulfate
OH^-	Hydroxide	O_2^{2-}	Peroxide
CN^-	Cyanide	$C_2O_4^{2-}$	Oxalate
NCS^-	Thiocyanate		
HCO_3^-	Hydrogen carbonate (bicarbonate)	CO_3^{2-}	Carbonate
ClO^-	Hypochlorite	CrO_4^{2-}	Chromate
ClO_2^-	Chlorite	$Cr_2O_7^{2-}$	Dichromate
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		
$H_2PO_4^-$	Dihydrogen phosphate	HPO_4^{2-}	Hydrogen phosphate
$C_2H_3O_2^-$	Acetate	PO_4^{3-}	Phosphate
MnO_4^-	Permanganate	PO_3^{3-}	Phosphite
		BO_3^{3-}	Borate
NH_2^{-1}	Amide		
NH_4^{+1}	**Ammonium ***Only positive poly on this list!!**		

**The different colored shading is attempting to show relationships between various polys. Grouping information helps you better retain this information for the long term. If left unshaded…sorry, no relationship on this list.

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d. Diatomics

Diatomics are non-metal elements that when found alone must be covalently bonded to another atom of themselves to be stable. These 7 elements will always have a subscript of "2" when written by themselves.

Diatomic Elements	
H_2	Hydrogen
N_2	Nitrogen
F_2	Fluorine
O_2	Oxygen
I_2	Iodine
Cl_2	Chlorine
Br_2	Bromine

How to Remember the Diatomic Elements

- Six of them make a "7" in the periodic table on the right hand side plus hydrogen to make the 7th element of the list

- The elements ending with "-gen" plus the halogens form diatomic molecules.

- An easy-to-remember mnemonic for the diatomic elements is: **H**ave **N**o **F**ear **O**f **I**ce **C**old **B**eer

e. Metric Prefixes and conversion factors

- Make sure you know the symbol for each and how to convert between any that are given to you.

Prefix	Symbol for Prefix		Scientific Notation
exa	E	1 000 000 000 000 000 000	10^{18}
peta	P	1 000 000 000 000 000	10^{15}
tera	T	1 000 000 000 000	10^{12}
giga	G	1 000 000 000	10^{9}
mega	M	1 000 000	10^{6}
kilo	k	1 000	10^{3}
hecto	h	100	10^{2}
deka	da	10	10^{1}
----	--	1	10^{0}
deci	d	0.1	10^{-1}
centi	c	0.01	10^{-2}
milli	m	0.001	10^{-3}
micro	μ	0.000 001	10^{-6}
nano	n	0.000 000 001	10^{-9}
pico	p	0.000 000 000 001	10^{-12}
femto	f	0.000 000 000 000 001	10^{-15}
atto	a	0.000 000 000 000 000 001	10^{-18}

f. Other Conversion Factors (Temperature, Energy, Moles etc)

- Be familiar and able to work any of these simple conversions.
- Additional resources can be found in **5 Steps to a 5** pages46-48.

Other Conversion Factors	
Temperature	K = C + 273
	°F = °C x 9/5 + 32
	°C = (°F - 32) x 5/9
Energy	1 cal = 4.184 J
	1 Cal = 1000 cal
Moles	1 mol = 6.02 x 10^{23} particles
	1 mol= molar mass on PT (in grams)
Gases	1 atm = 760 torr = 760 mm Hg = 101.3 kPa
	STP = 1 atm @ O*C
	1 mol= 22.4L of gas @STP

g. Naming compounds (nomenclature)

- Refer to http://science.widener.edu/svb/pset/nomen_b.html
  - Should be **VERY** comfortable naming: Ionic cmpds, Covalent Cmpds, Polys, and Acids