Carroll High School Advanced and GT Chemistry Summer Assignment

Welcome to the World of Chemistry! I look forward to having you in my GT or Advanced Chemistry class this school year. In order to make this year even better, you will need to have a working knowledge of chemical symbols, charges of common ions, and using these ions to write chemical formulas for compounds.
To assist with this endeavor, you will be working with a set of virtual ***flashcards*** to help you to learn some of the monatomic and polyatomic ions that will be used throughout the year. One set is for monatomic ions and the other for polyatomic ions. You will also learn and practice writing simple ionic compounds using the monatomic ions.
We will spend a brief period reviewing the content within this packet during the first week of school. **Expect a quiz over applying your skills at writing chemical formulas the 2nd WEEK of class.** There will be checkpoints throughout the first semester to gauge the progress of memorizing monatomic and polyatomic ions as well.

It's going to be a great year! If you have any questions during the summer months, please email julie.mccurley@southlakecarroll.edu.

To complete your summer assignment, do the following:

1. Use the virtual flashcards to review the ions you will use in chemistry this year. (see full list on page 2)
   - Monatomic Ions
   - Polyatomic Ions

2. After spending time working with the ions, test your memory of the ions by taking the monatomic and polyatomic ion practice quizzes. You will complete **5 attempts** of each of the **6 quizzes** and record your results in the Virtual Self Check Log
   - Monatomic Ion Quiz #1
   - Monatomic Ion Quiz #2
   - Monatomic Ion Quiz #3
   - Monatomic Ion Quiz #4
   - Polyatomic Ion Quiz #1
   - Polyatomic Ion Quiz #2

   Click HERE for a resource to copy and paste superscripts or subscripts into a Google Form quiz!

3. Access the websites below to begin learning and practicing how to use monatomic ions to write simple ionic compounds:
   - Binary Compounds of Metals with Fixed Charges Given Formula Write the Name - Record the results of the 3 practice sets on your virtual log.
   - Binary Compounds of Metals with Fixed Charges Given Name Write the Formula - Record the results of the 3 practice sets on your virtual log.
   - Binary Compounds of Cations with Variable Charges Given Formula Write the Name - Record the results of the 3 practice sets on your virtual log.
   - Binary Compounds of Cations with Variable Charges Given Name Write the Formula - Record the results of the 3 practice sets on your virtual log.

***This is a Required Assignment for Advanced/GT Chemistry ***

- Time Required – approximately 3 hours (varies by student)
- Chemistry TEKS 7A, 7B
- PreAP Chemistry Course Framework Key Concept: 2.3.D.1 Create and/or evaluate representations of ionic and covalent compounds.
- Learning Target: Write chemical formulas and names for ionic compounds using the ions presented in this summer assignment. This target supports curriculum concepts of atomic structure, bonding, chemical reactions, stoichiometry, solutions, acids/bases, and thermochemistry.

ION MEMORIZATION LIST

Directions: Begin familiarizing yourself with this list of ions. It is important that you know the ions exactly AS THEY ARE TYPED. This includes capital or lowercase letters, subscripts, +/- charge, and magnitude of charge (superscript numbers). The spelling of the ion name must also be exactly correct. Even a one letter difference means the difference between sulfate (SO_4^{2-}) and sulfite (SO_3^{2-}). ***Look for patterns to make memorization easier***.

You must understand these terms:
MONATOMIC ION = single atom with a charge.
POLYATOMIC ION = group of atoms with a charge.

MONATOMIC IONS (see periodic table)

Positive

1+	2+	3+	4+
H^+ Hydrogen	Be^{2+} Beryllium	Al^{3+} Aluminum	C^{4+} Carbon
Li^+ Lithium	Mg^{2+} Magnesium		Si^{4+} Silicon
Na^+ Sodium	Ca^{2+} Calcium		
K^+ Potassium	Sr^{2+} Strontium		
Rb^+ Rubidium	Ba^{2+} Barium		
Cs^+ Cesium	Ra^{2+} Radium		
Fr^+ Francium			

Negative

(notice all monatomic negative ions end with –ide)

1-	2-	3-	4-
F^- Fluoride	O^{2-} Oxide	N^{3-} Nitride	C^{4-} Carbide
Cl^- Chloride	S^{2-} Sulfide	P^{3-} Phosphide	Si^{4-} Silicide
Br^- Bromide	Se^{2-} Selenide	As^{3-} Arsenide	
I^- Iodide	Te^{2-} Telluride		
At^- Astatide			
H^- Hydride			

MULTIPLE CHARGED MONATOMIC IONS

(notice Roman numerals) **Transitional Metals have variable charges; therefore, patterns are less discernible.**

Cu^+ Copper (I)	Fe^{2+} Iron(II)	Pb^{2+} Lead(II)	Mn^{2+} Manganese (II)
Cu^{2+} Copper (II)	Fe^{3+} Iron(III)	Pb^{4+} Lead(IV)	Mn^{3+} Manganese (III)
Sn^{2+} Tin (II)	Hg_2^{2+} Mercury (I)	Co^{2+} Cobalt (II)	Ni^{2+} Nickel (II)
Sn^{4+} Tin (IV)	Hg^{2+} Mercury (II)	Co^{3+} Cobalt (III)	Ni^{3+} Nickel (III)
Cr^{2+} Chromium (II)	Au^{1+} Gold (I)	Ti^{3+} Titanium (III)	
Cr^{3+} Chromium (III)	Au^{3+} Gold (III)	Ti^{4+} Titanium (IV)	
V^{3+} Vanadium (III)	V^{5+} Vanadium (V)		

CONSTANT CHARGE TRANSITION METAL IONS

(notice absence of Roman Numerals)

Ag^+	Silver
Cd^{2+}	Cadmium
Zn^{2+}	Zinc

POLYATOMIC IONS

Positive

$(NH_4)^+$	Ammonium
$(H_3O)^+$	Hydronium

Negative

1-		2-		3-	
$(C_2H_3O_2)^-$	Acetate	$(CO_3)^{2-}$	Carbonate	$(PO_4)^{3-}$	Phosphate
$(CH_3COO)^-$	Acetate*	$(Cr_2O_7)^{2-}$	Dichromate	$(PO_3)^{3-}$	Phosphite
$(OH)^-$	Hydroxide	$(C_2O_4)^{2-}$	Oxalate		
$(CN)^-$	Cyanide	$(O_2)^{2-}$	Peroxide		
$(MnO_4)^-$	Permanganate	$(SO_4)^{2-}$	Sulfate		
$(ClO)^-$	Hypochlorite	$(SO_3)^{2-}$	Sulfite		
$(ClO_2)^-$	Chlorite	$(HPO_4)^{2-}$	Hydrogen phosphate		
$(ClO_3)^-$	Chlorate	$(CrO_4)^{2-}$	Chromate		
$(ClO_4)^-$	Perchlorate	$(SiO_3)^{2-}$	Silicate		
$(HCO_3)^-$	Hydrogen carbonate (bicarbonate)				
$(BrO_3)^-$	Bromate				
$(NO_3)^-$	Nitrate				
$(NO_2)^-$	Nitrite				
$(H_2PO_4)^-$	Dihydrogen phosphate				
$(IO_3)^-$	Iodate				
$(HSO_4)^-$	Hydrogen sulfate (bisulfate)				
$(HSO_3)^-$	Hydrogen sulfite (bisulfite)				

Ions and Symbols

An **ion** is an atom or molecule in which the total number of electrons is not equal to the total number of protons, giving it a net positive or negative electrical charge. An **anion**,is an ion with more electrons than protons, giving it a net negative charge (since electrons are negatively charged and protons are positively charged). Conversely, a **cation**,is an ion with more protons than electrons, giving it a positive charge.

An ion consisting of a single atom is a **monatomic ion**. If it consists of two or more atoms, it is a **polyatomic ion**. When writing the chemical formula or symbol for an ion, its charge is written as a superscript "+" or "−" following a number. This indicates the difference between the number of protons and the number of electrons. The number is omitted if it is equal to 1. For example, the sodium cation is written as Na^{+}, the "+" indicates that *one electron* was lost from this atom so it has more protons than electrons. The sulfate polyatomic anion is written as SO_4^{2-}, the "2−" indicating that *two electrons* were gained to form this charged group of elements.

If the above paragraph seems confusing, think about it this way. Lithium, sodium, potassium, etc… have a +1 because that is how many electrons they need to lose to have 8 valence (outermost energy level of the atom) electrons.

In chemistry, **valence electrons** are the outermost electrons of an atom, which are important in determining how the atom reacts chemically with other atoms. The number of valence electrons of an element is determined by its periodic table group (vertical column) in which the element is categorized. If you number the “tall” columns or groups on the periodic table (representative elements) from left to right, this column number will remind you of how many valence electrons any element in that column or group has. For example, chlorine is in group 7, so the atoms of chlorine have 7 valence electrons. In knowing how many valence electrons an element’s atom contains, you can determine how many it needs to gain or lose to reach “8” valence electrons.

Some helpful hints for remembering the charges of certain monatomic ions using the periodic table! **YOU'LL ALWAYS GET A PERIODIC TABLE ON EVERY QUIZ AND TEST THROUGHOUT THE YEAR!**

Notice this column has all +1 charges.

Notice this column has all +2 charges.

Look for patterns

PERIODIC TABLE OF THE ELEMENTS

1 H 1.0079																	2 He 4.0026
3 Li 6.941	4 Be 9.012											5 B 10.811	6 C 12.011	7 N 14.007	8 O 16.00	9 F 19.00	10 Ne 20.179
11 Na 22.99	12 Mg 24.30											13 Al 26.98	14 Si 28.09	15 P 30.974	16 S 32.06	17 Cl 35.453	18 Ar 39.948
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 54.938	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 (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 § (269)	111 § (272)	112 § (277)						

*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 237.05	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 (260)

§Not yet named