AP Chemistry Summer Work 2020

Feel free to use online resources—there are so many! Focus on understanding the below topics. Most of these topics are review from honors/first year chemistry.

Complete the following ***before*** **the first day of school**. For number 1, **bring the packet to class the first day of school. For number 2, bring the paper to class on the first day of school. For numbers 3-17, complete the tasks on stapled paper with your handwritten answers neatly numbered.**

1. Complete the chapters 1-3 practice test packet found at this link—**the packet is linked under the video**—: https://www.youtube.com/watch?v=ZGCUCwO4RGw&list=PLmtMZsGcmFltpwSFM7mSS_oTaIrS71sH2**. You may print and write on the packet, or CLEARLY label the question number and letter, and write on notebook or copy paper.** Complete the packet FIRST, then use the video to check your answers. **Bring this packet (OR YOUR STAPLED HANDWRITTEN WORK) to class the first day of school.**
2. Bring a sheet of paper with your favorite element from the periodic table to the first day of class. Indicate the element symbol, atomic number, and atomic mass. Be prepared to explain both atomic number and atomic mass.

For questions 3-17 below, you should have a stapled packet of handwritten work. For most questions, questions are posed, or you are told what to write. Number your work 3-17. Where practice problems are indicated, complete practice problems. Where review is indicated, take notes, or list out the material you have to know. Please read EACH NUMBER CAREFULLY to ensure all work is completed.

Almost all of this content was covered in honors/first year chemistry. You will find some resources at the end of this document. You can also find resources online.

3. Know the symbol and charge for elements 1-86, excluding the lanthanides and actinides. Write out these symbols and the charges these elements form as ions.
4. Review the periodic trends in atomic and ionic radii, electronegativity, and first ionization energy. Clearly explain each of these trends.
5. Review the strong acids and strong bases (names and formulas). You should write these names and formulas out on your paper. Be able to list these from memory (flashcards are helpful!)
6. Write out the rules for naming and assigning formulas to acids (**see below**)
7. Review significant figures. Write out the rules for significant figures.
8. Review the symbols and names of polyatomic ions (**see below**). Write out these symbols and names.
9. Review the prefixes for molecular compounds (mono, di, etc.). Create a table of these prefixes.
10. Understand how to write and name binary ionic *and* covalent compounds. Write out these rules.
    *For example, can you name $CaCl_2$ (binary ionic) and CCl_4 (covalent)?
11. Understand the variable valences of the transition metals (**see below**). Just review. No need to write anything here.

12. Know the prefixes used in the SI system (giga through pico). Write out these prefixes in an organized manner.
13. Understand how to perform unit conversions using dimensional analysis. Convert 10 moles of sodium chloride to mass. Convert 110 g of calcium sulfate to moles. Show your work for each question.
14. Understand how to assign oxidation numbers to elements. List out these rules. (**see below**)
15. Review balancing reactions and identifying limiting reagents. To help you, watch the videos in the order listed.
    - Helpful video on balancing reactions: https://www.youtube.com/watch?v=eNsVaUCzvLA&t=642s
    - Helpful video on mole to gram conversions: https://www.youtube.com/watch?v=CMnkSb2YsXI
    - and lastly, here is a helpful video on limiting reagents: https://www.youtube.com/watch?v=LQq203gyftA (don't worry about titrations).
16. TAKE NOTES AND WORK THE PROBLEMS PRESENTED IN THE 3 VIDEOS IN NUMBER 15.
17. Print the following pages, and write out the formulas/names as indicated in the red text.

See below for resources.

Common Ions

Many compounds consist of **ions** rather than molecules. Such compounds are said to be ionic. An ion is an electrically charged "package" consisting of one (**monatomic ion**) or more (**polyatomic ion**) atoms. An ion with a positive charge is called a **cation** (CAT-ion), while an ion with a negative charge is called an **anion** (AN-ion).
Ionic compounds do not exist as molecules and so do not have molecular formulas. Rather, ionic substances such as sodium chloride and magnesium chloride have only empirical formulas—NaCl and $MgCl_2$, respectively.

The charges on many atomic ions can be predicted using the periodic table. In general, for a nonmetal to form an ion, it will gain as many electrons as it needs in order to have the same number of electrons as a noble gas. Metals will lose electrons to become cations, while nonmetals will gain electrons to become anions.

Some transition metals can form more than one ion. Iron, for example, forms both Fe^{2+} and Fe^{3+}. To name such an ion unambiguously, we use the name of the element, a Roman numeral in parentheses to denote the charge, and the word "ion." Fe^{2+} and Fe^{3+} would be iron(II) ion and iron(III) ion, respectively. An older method, though still widely used, is to apply the endings *–ous* for the smaller ionic charges and *–ic* for the larger ionic charges. For example:

Fe^{2+} is a ferr**ous** ion Fe^{3+} is a ferr**ic** ion

Cu^{+} is a cupr**ous** ion Cu^{2+} is a cupr**ic** ion

Common Cations

Charge	Formula	Name	Charge	Formula	Name
+1	H^+	Hydrogen ion	+1	Cs^+	Cesium ion
	Li^+	Lithium ion		Ag^+	Silver ion

	Na^+	Sodium ion		Cu^+	Copper (I) or Cuprous ion
	K^+	Potassium ion		NH_4^+	Ammonium ion
				H_3O^+	Hydronium ion
+2	Mg^{2+}	Magnesium ion	+2	Co^{2+}	Cobalt or Cobaltous ion
	Ca^{2+}	Calcium ion		Cu^{2+}	Copper (II) or Cupric ion
	Sr^{2+}	Strontium ion		Fe^{2+}	Iron (II) or Ferrous ion
	Ba^{2+}	Barium ion		Hg_2^{2+}	Mercury (I) ion
	Zn^{2+}	Zinc ion		Hg^{2+}	Mercury (II) ion
	Cd^{2+}	Cadmium ion		Ni^{2+}	Nickel (II) ion
	Pb^{2+}	Lead or Plumbous ion		Mn^{2+}	Manganese (II)
	Sn^{2+}	Tin(II) or Stannous ion			

Common Anions

Charge	**Formula**	**Name**	**Charge**	**Formula**	**Name**
1-	H^-	Hydride ion	1-	CN^-	Cyanide ion
	F^-	Fluoride ion		OH^-	Hydroxide ion
	Cl^-	Chloride ion		$C_2H_3O_2^-$	Acetate ion
	Br^-	Bromide ion		ClO^-	Hypochlorite ion
	I-	Iodide ion		ClO_2^-	Chlorite ion
	NO_2^-	Nitrite ion		ClO_3^-	Chlorate ion
	NO_3^-	Nitrate ion		ClO_4^-	Perchlorate ion
	MnO_4^-	Permanganate ion		$H_2PO_4^-$	Dihydrogen phosphate ion
	HCO_3^-	Hydrogen carbonate ion (or bicarbonate ion)		SCN^-	Thiocyanate ion
				HSO_4^-	Hydrogen sulfate ion
				N_3^-	Azide ion
2-	O^{2-}	Oxide ion	2-	CO_3^{2-}	Carbonate ion
	O_2^{2-}	Peroxide ion		CrO_4^{2-}	Chromate ion
	S^{2-}	Sulfide ion		$Cr_2O_7^{2-}$	Dichromate ion
	$S_2O_3^{2-}$	Thiosulfate ion		SO_3^{2-}	Sulfite ion
	HPO_4^{2-}	Hydrogen phosphate ion		SO_4^{2-}	Sulfate ion
				$C_2O_4^{2-}$	Oxalate ion
3-	N^{3-}	Nitride ion	3-	PO_4^{3-}	Phosphate ion
	P^{3-}	Phosphide ion		PO_3^{3-}	Phosphite ion

Note that polyatomic ions that contain oxygen have names that end in either *–ite* for the smaller number of oxygens or *–ate* for the larger number of oxygens. For Example:

NO_2^-	Nitr**ite** ion	SO_3^{2-}	Sulf**ite** ion
NO_3^-	Nitr**ate** ion	SO_4^{2-}	Sulf**ate** ion

Prefixes are used when the series of oxyanions of an element extends to four members. The prefix *per-* indicates one more oxygen, while the prefix *hypo-* indicates one less oxygen. For example:

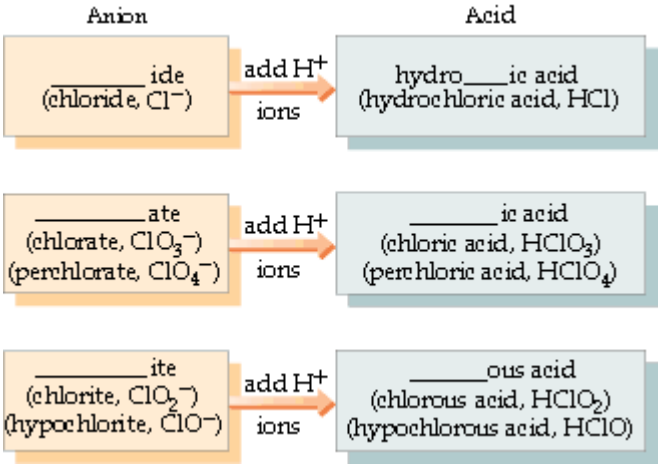
ClO^-	**Hypo**chlor**ite** ion	BrO^-	**Hypo**brom**ite** ion
ClO_2^-	Chlor**ite** ion	BrO_2^-	Brom**ite** ion
ClO_3^-	Chlor**ate** ion	BrO_3^-	Brom**ate** ion
ClO_4^-	**Per**chlor**ate** ion	BrO_4^-	**Per**brom**ate** ion

Naming Acids:

Names and formulas of acids follow naturally from the naming of ionic compounds. (Even though acids are *not* ionic!) A working definition of acid for this exercise will be: an anion with enough hydrogen ions attached to make it neutral. Thus, Cl^- requires one hydrogen ion to become HCl, a familiar acid. SO_4^{2-} requires two hydrogen ions to become H_2SO_4, another familiar acid.

To name an acid derived from an atomic anion, remove the *ide* ending from the anion, replace it with *ic*, and surround the new name with the prefix *hydro* and the word *acid*. Example: The anion in HCl is the chloride ion. Remove the *ide* ending, and replace it with *ic*. Surround the new word with *hydro* and *acid*, and you have hydrochloric acid.

For acids derived from polyatomic anions, simply replace the suffix of the anion name and add the word *acid*. The ending *ate* gets replaced with *ic*; the ending *ite* gets replaced with *ous*. The acid derived from nitrate ion becomes nitric acid. That derived from nitrite ion becomes nitrous acid. (Some of the anion roots change slightly for acid names. Example: The acids derived from sulfate and sulfite ions are sulfuric and sulfurous acids, respectively.)



Rules for assigning oxidation states

1. Oxidation state of an atom in an element = 0
2. Oxidation state of monatomic element = charge the element takes as an ion
3. Oxygen = -2 in covalent compounds (except in peroxides where it = -1)
4. H = +1 in covalent compounds
5. Fluorine = -1 in compounds
6. Sum of oxidation states = 0 in compounds
7. Sum of oxidation states = charge of ions

Common mono, di & polyatomic ions—**write the symbols.**

I) Name (Ion) Symbol (as an ion)

a) Sodium
b) Potassium
c) Cesium
d) Beryllium
e) Calcium
f) Strontium
g) Barium
h) Gallium
i) Aluminum
j) Nitrogen
k) Arsenic
l) Bismuth
m) Oxygen
n) Fluorine
o) Chlorine
p) Bromine
q) Iodine

Common ions of transition elements—**write the ion symbols**

Ion Name	**Ion**
a) Chromium(III)	
b) Manganese(II)	
c) Iron(II) or Ferrous	
d) Iron(III) or Ferric	
e) Cobalt(II)	
f) Nickel(II) or nickel	
g) Copper(II) or Cupric	
h) Zinc	
i) Silver	
j) Cadmium	
k) Mercury(II) or mercuric	

Common Polyatomic Ions and Acids—write the formulas for the acids and ions.

Name	Formula	Name	Formula
a) Acetate		b) Ammonium	
c) Carbonate		d) Chlorate	
e) Chlorite		f) Chromate	
g) Cyanide		h) Dichromate	
i) Dihydrogen Phosphate		j) Dihydrogen Phosphate	
k) Hydrogen Carbonate		l) Hydrogen Sulfate	
m) Hydrogen Sulfite		n) Hypochlorite	
o) Hydroxide		p) Nitrate	
q) Nitrite		r) Oxalate	
s) Perchlorate		t) Permanganate	
u) Phosphate		v) sulfate	
w) sulfite		x) Thiosulfate	

Write the formulas for each acid (you also need to be able to go from formula to name)

Common Acids	Formula	Common Acids	Formula
Hydrochloric Acid		Phosphoric acid	
Carbonic acid		Sulfurous Acid	
Nitrous acid		Sulfuric Acid	
Nitric Acid		Hypochlorous Acid	
Chlorous Acid		Chloric Acid	
		Perchloric acid	