Welcome to AP Chemistry!

Students enrolled in AP chemistry will be asked to reinforce skills and knowledge accumulated in the first year chemistry class (Honors Chemistry) during the summer before the beginning of the AP course. This will allow us to focus our attention on the advanced chemistry topics and 16 suggested labs that will be tested on the AP exam in May 2024.

Your summer assignment consists of the following:

1. **Review the objectives** taught in Chemistry Honors for the Atomic Structure & Periodicity, Stoichiometry and Chemical Reactions units. **A diagnostic exam to test your readiness for AP Chemistry will be given the second day the class meets.**
2. Review the Solubility Rules, Polyatomic Ions, Strong Acids and Bases, and General Rules for Completing Chemical Equations (all attached). All these will be tested in the diagnostic test.
3. **Lab preparation.** Go to the website below and read all the Glassware and Techniques. This is important as some questions on the AP test require knowledge of these. Your knowledge of these glassware and techniques will be also tested in the diagnostic test. https://www.michigan.gov/documents/deq/wrd-ot-lab-glassware_445272_7.ppt
4. Answer ALL questions on the assignment included in this document (pages 4 through 10) in the space provided. Assignment is **due on the first day of school.**

Please take the assignment seriously and start in early August—there's a lot to do and you won't be able to complete it all on the night before it's due.

If at any time you would like to ask me a question, please email me at agarciaminsal@dadeschools.net. Have a great summer. I look forward to beginning our journey together in August.

Mrs. Minsal ☺

Polyatomic Ion Names

Must be memorized by the first day of school!

1+

ammonium, NH_4^+

hydronium, H_3O^+

1-

acetate, $C_2H_3O_2^-$, or CH_3COO^-

perchlorate, ClO_4^-

chlorate, ClO_3^-

chlorite, ClO_2^-

hypochlorite, ClO^-

cyanide, CN^-

hydrogen carbonate, HCO_3^- (also called bicarbonate)

hydrogen sulfate, HSO_4^-

hydroxide, OH^-

nitrate, NO_3^-

nitrite, NO_2^-

permanganate, MnO_4^-

thiocyanate, SCN^-

2-

carbonate, CO_3^{2-}

chromate, CrO_4^{2-}

dichromate, $Cr_2O_7^{2-}$

oxalate, $C_2O_4^{2-}$

peroxide, O_2^{2-}

sulfate, SO_4^{2-}

sulfite, SO_3^{2-}

thiosulfate, $S_2O_3^{2-}$

3-

phosphate, PO_4^{3-}

phosphite, PO_3^{3-}

arsenate, AsO_4^{3-}

Strong Acids	Strong Bases.
HCl	Group I hydroxides (LiOH, NaOH, KOH, etc)
HBr	$Ca(OH)_2$
HI	$Sr(OH)_2$
H_2SO_4	$Ba(OH)_2$
HNO_3	
$HClO_4$	
$HClO_3$	

Solubility Rules (P A G A N)

1. All compounds that contain a Group I element (alkali metal) are soluble.

2. All compounds that contain an Ammonium ion (NH_4^+) are soluble.

3. All compounds that contain a Nitrate ion (NO_3^-), Acetate ion ($C_2H_3O_2^-$), and Perchlorate ion (ClO_4^-) are soluble.

4. All other compounds are INSOLUBLE, unless otherwise noted.

Name: _____ Date: _____

AP Chemistry Mrs. Minsal

Due on Monday August 21st.

Directions: Answer the following five questions in the spaces provided.

1. Explain each of the following observations using principles of atomic structure

a) Write the ground state electron configuration for a chlorine atom.

_____

b) Predict the charge on the chlorine ion. _____

c) Write the ground state electron configuration for a chlorine ion.

_____

d) Is an isolated chlorine atom in the ground state paramagnetic or diamagnetic? Explain.

_____

_____

_____

e) Explain how the electron configuration of the chlorine atom in the ground state is consistent with the existence of the following known compounds: NaCl, SCl_2. Use Lewis structures is necessary.

_____

_____

_____

_____

_____

f) Write the ground state electron configuration for an iron atom.

_____

g) Write the ground state electron configuration for iron(III) ion.

_____

2. Explain each of the following observations using principles of atomic structure.

a) Potassium has a lower first-ionization energy than lithium.

_____

_____

_____

_____

_____

b) The ionic radius of N^{3-} is larger than that of O^{2-}.

_____

_____

_____

_____

_____

c) A chlorine atom is smaller than a magnesium atom.

_____

_____

_____

_____

_____

3. Calculate the volume, in liters, of 0.589 M H_2SO_4 that can be completely neutralized with 2.46 grams of sodium bicarbonate $NaHCO_3$.

4. a) Write the net ionic equation for the neutralization reaction between solutions of nitric acid and barium hydroxide.

b) The molarity of nitric acid is to be determined using titration. A 25.00 mL sample of the acid is titrated with 0.100 M of barium hydroxide. The equivalence point was achieved with 48.6 mL of the base. Calculate the molarity of the nitric acid.

c) What is the pH of the nitric acid?

5. Answer the following questions about $MgSO_4(s)$ and its hydrate.

When heated to 310.°C, $MgSO_4 \cdot X\ H_2O\ (s)$ dehydrates completely as represented below.

$$MgSO_4 \cdot X\ H_2O\ (s) \rightarrow MgSO_4\ (s) + X\ H_2O(g)$$

A student weighs an empty clean and dried crucible, adds some of the hydrate to the crucible and weighs the crucible again. Then the student heats up the crucible at 310.°C for 10 minutes, lets the crucible + residue cool down and weighs again. The student repeats this last step again. The table below contains data collected by the student during the experiment.

Mass of empty crucible	6.849 g
Mass of crucible and $MgSO_4 \cdot X\ H_2O$	12.330 g
Mass of crucible and $MgSO_4$ after first heating	9.589 g
Mass of crucible and $MgSO_4$ after second heating	9.587 g

a) Calculate

i. The mass of $MgSO_4$ (s) formed.

ii. The mass of water contained in the hydrate.

iii. The volume of the $H_2O(g)$ released, measured at STP conditions.

iv. The empirical formula of the hydrate, $MgSO_4 \cdot X\ H_2O$

b) Identify sources of possible errors in the experiment that could explain the experimental results.

_____

_____

_____

_____

_____

6. A 2.00×10^{-3} mole sample of pure acetylsalicylic acid (a monoprotic acid, MM: 180.157g/mol) was dissolved in enough water to make 15.00 mL of solution and then titrated with 0.100 M NaOH(aq). Calculate:

a) The molarity of the acetylsalicylic acid.

b) The number of molecules of acetylsalicylic acid in the solution before titration.

c) The volume of NaOH required to react with the acid.

7. $Fe(s) + O_2(g) \longrightarrow Fe_2O_3(s)$

Iron reacts with oxygen to produce iron(III) oxide, as represented by the equation above.

A 65.0 g sample of Fe(s) is mixed with 21.0 L of $O_2(g)$ at 25.0°C and 763.4 torr

a) Identify the substance that is oxidized and the one being reduced.

b) Calculate the number of moles of each reactant before the reaction begins.

c) Identify the limiting reactant when the mixture is heated to produce $Fe_2O_3(s)$. Support your answer with calculations.

d) Calculate the number of moles of Fe_2O_3 (s) produced when the reaction proceeds to completion.

8. Aqueous XO_4^{3-} form a precipitate with aqueous silver ions, Ag^+. Write the net ionic equation for the reaction, including the state symbols.

a) Excess of aqueous K_3XO_4 is added to 41.18 mL of a 0.2040 M solution of $AgNO_3$ to force all the product to precipitate. The mass of the precipitate formed is 1.172 g.

i. Calculate the amount, in moles, of Ag^+ ions used in the reaction.

ii. Calculate the moles of the precipitate formed from the Ag^+ ions.

iii. Calculate the molar mass of the precipitate.

iv. Determine the atomic mass of X and identify the element.

9. For the molecules below

i. Draw the Lewis structure.

ii. State the molecular symmetry.

iii. State the strongest intermolecular force present between the molecules of the same compound.

a) CF_4

i	ii	iii

b) NCl_3

i	ii	iii

c) H_2O

i	ii	iii

d) CH_3OH

i	ii	iii
H | H – C – O – H | H		

e) CO_2

i	ii	iii

10. Propanoic acid, $HC_3H_5O_2$, is a weak monoprotic acid. The equation for the dissociation of propanoic acid is described below:

$$HC_3H_5O_2(aq) + H_2O(l) \rightleftarrows C_3H_5O_2^-(aq) + H_3O^+(aq)$$

_____ _____ _____ _____

a) On the lines above, identify the acid -conjugate base and base-conjugate acid pairs.

A student titrates 25.00 mL of the acid with 0.124 M NaOH. The end point used 23.59 mL of the base.

b) Write the balanced chemical equation between propanoic acid and NaOH.

c) Calculate the concentration of the acid.