AP CHEMISTRY SUMMER ASSIGNMENT 2025-2026

WELCOME TO AP CHEM!!

I am eagerly anticipating a great year! Preparation for the upcoming year in AP Chemistry will put you ahead of the game at the beginning of the school year and allow me to spend less time reviewing and more time teaching new topics. This will greatly improve your chances of success both in the class and on the AP exam.

INSTRUCTIONS:

1. **Familiarize yourself with the Periodic Table**. You should quickly recognize the symbols (name them) and their positions on the Periodic Table for the first 50 elements. Use your periodic table from class this past year as a reference/study aid.
2. **Memorize the list of sixty familiar ions**. You should be able to write the symbol/charge of the ion given the name and vice versa.
    - Included is a list of ions by name and four practice quizzes.
    - Make flashcards for all the ions and arrange them by groups based on patterns you observe. For example, which ones are made of only one element / several elements? Which ones have positive charges vs. negative charges? If it's an ion from a single element, where is it located on the periodic table? Which ones have several possible charges? How are they named, e.g. – ium, -ide, -ate, -ite, hypo-, per-, bi-, thio-, -ous, -ic?
    - You should be able to complete the practice quiz in less than 5 minutes without trouble. (Basically you need to know your ions better than your multiplication table.)
    - **There will be a *QUIZ* on the 2nd day of school.**
3. **Complete the Review questions/problems**. If you need to review any topics, you may find the following YouTube videos to be helpful:
    - Crash Course Chemistry
    - Khan Academy
    - Tyler DeWitt
    - Professor Dave Explains
    - ChemistNATE
    - Bozeman science

    THIS HOMEWORK IS DUE ON THE FIRST DAY OF SCHOOL AND WILL BE GRADED. Please complete the Review neatly on a separate sheet of paper, showing your work when appropriate, and completely answering all questions. This assignment will take a while to complete so don't wait until the last minute. The better you are able to do these problems, the more prepared you will be to succeed in AP Chemistry.

****You are responsible for all material in the review and will be using it all year in the course.**

Remember, AP Chem is the equivalent of an introductory college course. Taking a college level chemistry course in high school is difficult, requires dedication, and is a great investment in your education, so prepare yourself and arrive ready to learn.

Have a great summer – be seeing you soon!
Mrs. Payne

AP Chemistry Summer Assignment

		Due Date
Topic 1	Significant Figures	
Topic 2	Metric and Temperature Conversions	
Topic 3	Nomenclature	
Topic 4	Atomic Structure	
Topic 5	Writing and Balancing Chemical Equations	
Topic 6	Moles and Stoichiometry	
Topic 7	Graphing and Data Analysis	
Topic 8	Particulate Drawings	
Topic 9	Elements and Ions to Memorize (Prepare Flash Cards)	

Suggested Timeline for completing assignment: (Adjust for vacation, etc.)

July 6-12: Topic 1 and Topic 2, Memorize elements/symbols on the elements and ions to memorize the left column on the ions list by name page

July 13-19: Topic 3 and Topic 4, Memorize the middle column on the ions list by name page

July 20-26: Topic 5 and Topic 6, Memorize the right column on the ions list by name page

July 37-August 2: Topic 7 and Topic 8, Review all ions and elements and take practice quiz #1

August 3-9: Review all ions and elements and take practice quizzes #2-#4

August 14: Summer assignment is due at the beginning of class

August 15: Quiz on all ions and element symbols assigned

Topic 1: Significant Figures

1. Determine the number of significant figures in each of the following:

   a. 0.7540 _____

   b. 12500 _____

   c. 1000.01 _____

   d. 1200 _____

   e. 1.04×10^3 _____

   f. 0.0080050 _____

2. Perform the following calculations and round to the appropriate number of significant figures:

   a. $34.66 + 333.0$ _____

   b. $1.23 + 9.66$ _____

   c. $455 - 1.22$ _____

   d. 18.2×1.998 _____

   e. $10.2 \div 1.34$ _____

   f. $\frac{100.23+59.4}{5.22}$ _____

3. Round each of the following numbers to three significant figures:

   a. 167.789 _____

   b. 0.00000445345 _____

   c. 25.0545 _____

   d. 3.1415926536 _____

   e. 8504.0435 _____

   f. 14.4355 _____

Topic 2: Metric and Temperature Conversions

1. Use dimensional analysis (factor-label method) to make the following metric conversions:

   a. 3.40 m to cm _____ × _____ = _____

   b. 289 cm to nm _____ × _____ × _____ = _____

   c. 125145 J to kJ _____ × _____ = _____

   d. 164 mg to g _____ × _____ = _____

   e. 46.5 mL to L _____ × _____ = _____

2. Make the following temperature conversions:

   a. 162°F to °C _____

   b. 0.0 °F to K _____

   c. -18 °C to K _____

   d. 212 K to °C _____

   e. 98.6 °F to K _____

Topic 3: Nomenclature

1. Name or write the formula for the following ionic compounds:

a. LiCl		g. tin(II) bromide	
b. $Mg(OH)_2$		h. potassium phosphate	
c. K_3P		i. nickel(II) perchlorate	
d. Fe_2O_3		j. sodium hydroxide	
e. FeO		k. zinc phosphate	
f. $ZnCl_2$		l. ammonium sulfate	

2. Name or write the formula for the following covalent compounds:

a. CO		e. nitrogen tribromide	
b. CBr_4		f. tetraphosphorus decaoxide	
c. SO_2		g. xenon hexafluoride	
d. N_2O_4		h. dicarbon tetrafluoride	

3. Name or write the formula for the following acids:

a. HCl		e. hydrobromic acid	
b. HNO_3		f. hydronitric acid	
c. $HC_2H_3O_2$		g. phosphoric acid	
d. H_2SO_4		h. hydrosulfuric acid	

Topic 4: Atomic Structure

1. Determine the number of protons, neutrons and electrons in each of the following:

   a. $^{39}_{19}K$ protons: _____ neutrons: _____ electrons: _____

   b. $^{23}_{11}Na^{1+}$ protons: _____ neutrons: _____ electrons: _____

   c. $^{208}_{82}Pb$ protons: _____ neutrons: _____ electrons: _____

   d. $^{33}_{15}P^{3-}$ protons: _____ neutrons: _____ electrons: _____

2. Write the symbol for the atom that contains
   a. 24 protons, 21 electrons and 24 neutrons

   b. 34 protons, 45 neutrons, 34 electrons

   c. 8 protons, 10 neutrons, 10 electrons

3. What experimental evidence supports these statements?
   a. The nucleus of an atom is small.

   b. The atom consists of both positive and negative charges.

   c. The nucleus of the atom is positive.

Topic 5: Writing and Balancing Chemical Equations

1. Balance the following chemical equations:
   a. ____ $Cr_{(s)}$ + ____ $O_{2(g)}$ → ____ $Cr_2O_{3(s)}$

   b. ____ $SiH_{4(g)}$ → ____ $Si_{(s)}$ + ____ $H_{2(g)}$

   c. ____ $SO_{3(g)}$ → ____ $SO_{2(g)}$ + ____ $O_{2(g)}$

   d. ____ $Pb(NO_3)_{2(s)}$ → ____ $PbO_{(s)}$ + ____ $NO_{2(g)}$ + ____ $O_{2(g)}$

   e. ____ $C_3H_{8(g)}$ + ____ $O_{2(g)}$ → ____ $CO_{2(g)}$ + ____ $H_2O_{(g)}$

   f. ____ $C_2H_5OH_{(l)}$ + ____ $O_{2(g)}$ → ____ $CO_{2(g)}$ + ____ $H_2O_{(g)}$

2. Write a balanced chemical equation for each of the following reaction descriptions:
   a. When solid calcium carbonate is heated, solid calcium oxide and gaseous carbon dioxide are formed.

   b. Aluminum metal reacts with oxygen to form solid aluminum oxide.

   c. When solid mercury(II) sulfide is heated with oxygen, liquid mercury metal and gaseous sulfur dioxide are produced.

   d. When aqueous solutions of aluminum sulfate and barium chloride are mixed, solid barium sulfate and aqueous aluminum chloride are formed.

   e. Solid sodium bicarbonate reacts with hydrochloric acid to produce sodium chloride, water, and carbon dioxide gas.

   f. Gaseous ammonia and oxygen react to produce nitrogen monoxide gas and water

Topic 6: Moles and Stoichiometry

1. Vinegar is a dilute solution of acetic acid, CH_3COOH.
   a. Calculate the molar mass of acetic acid.

   b. How many molecules of CH_3COOH are contained within 43.4 g of acetic acid?

   c. How much would 0.450 moles of acetic acid weigh?

2. How many moles of hydrogen gas can be produced if 1.35 g of solid zinc reacts with excess hydrochloric acid according to the equation

$$Zn + 2\ HCl \rightarrow H_2 + ZnCl_2$$

3. The reaction for the combustion of propane is

$$\_\_\_\ C_3H_8 + \_\_\_\ O_2 \rightarrow \_\_\_\_\ CO_2 + \_\_\_\ H_2O$$

   a. If 20.0 g of C_3H_8 and 20.0 g of O_2 are reacted, how many moles of CO_2 can be produced?

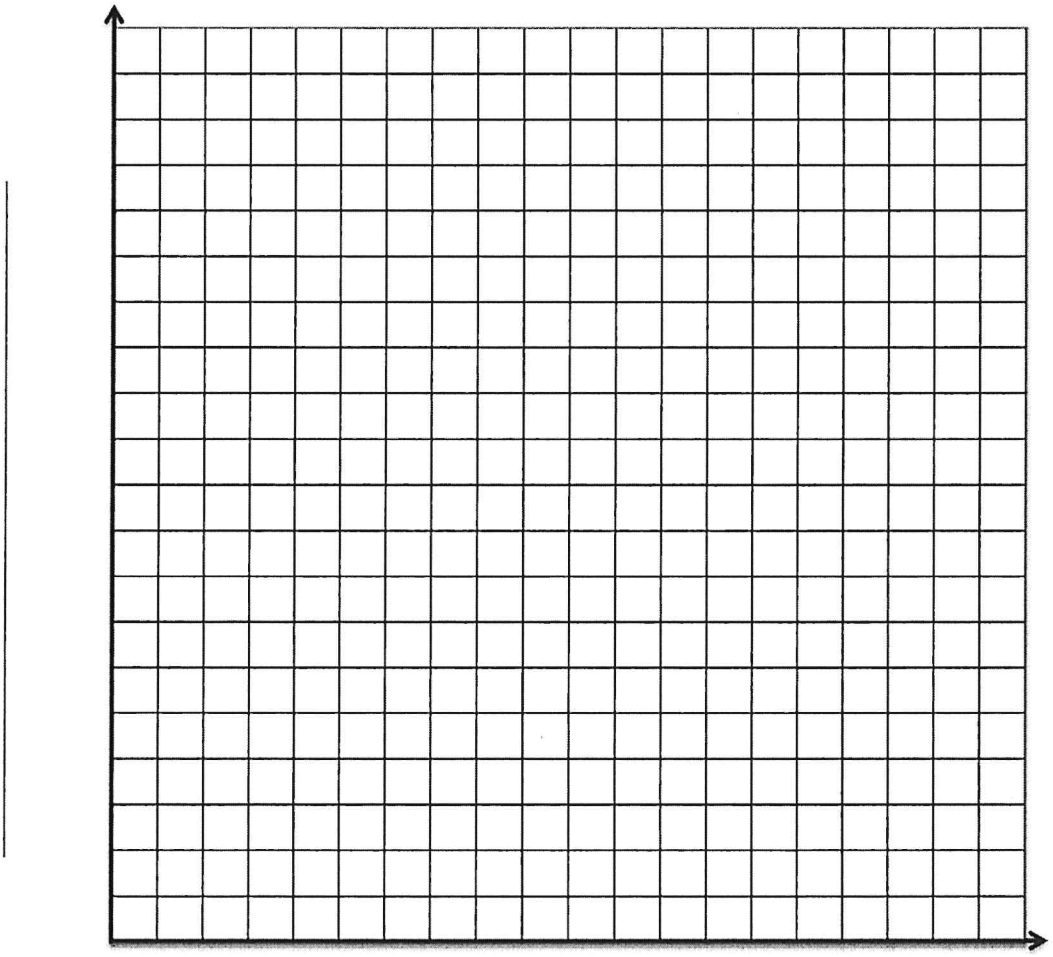
4. If 20.0 g of C_3H_8 and 80.0 g of O_2 are reacted, how many grams of CO_2 can be produced

Topic 7: Graphing and Data Analysis

4. When anhydrous calcium chloride is dissolved in water, the temperature of the system changes. A student obtains the following data when dissolving increasing amounts of $CaCl_2$ into 100 mL of water:

Mass of $CaCl_2$ dissolved, g	0.91	2.94	5.92	8.81	10.89
ΔT, °C	1.8	6.6	12.8	18.9	23.2

Plot the data on the graph below. Choose an appropriate scale, and label the axes appropriately.



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Refer to the graph to answer the following questions.

Independent Variable: _____

Dependent Variable: _____

Provide a descriptive title for the graph: _____

5. Describe the relationship between grams of calcium chloride salt and change in temperature in a sentence.

6. Draw a line of best fit. Determine its slope, including units.

7. Predict the change in temperature when (Look this up)

   a. 4.33 g of $CaCl_2$ are dissolved

   b. 9.56 g of $CaCl_2$ are dissolved

   c. 15.4 g of $CaCl_2$ are dissolved

8. Predict what mass of $CaCl_2$ will result in (look this up)

   d. a 12.4°C change in temperature

   e. a 44.9 °C change in temperature

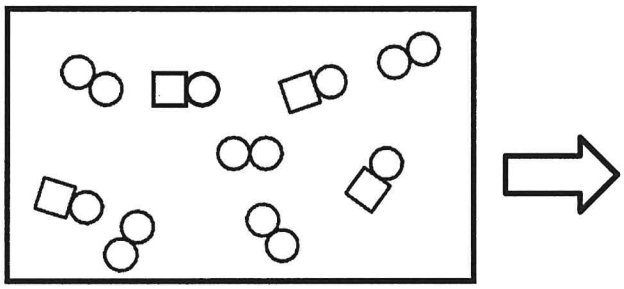
Topic 8: Particulate Diagrams

1. Consider the synthesis of nitrogen dioxide

$$2\ NO + 1\ O_2 \longrightarrow 2\ NO_2$$

   a. In the diagram below, nitrogen atoms are represented with squares and oxygen atoms are represented with circles. Using the conservation of matter, draw what you would expect to find in the reaction vessel once the reaction is complete.

Before Reaction: After Reaction

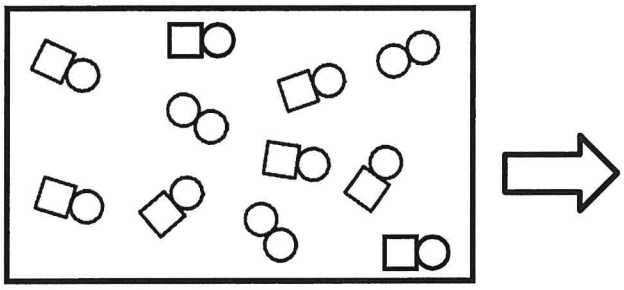


Limiting Reactant: Excess Reactant:

Explanation

   b. Consider the same reaction, with different starting quantities. Draw the contents of the reaction vessel after the reaction is complete.

Before Reaction: After Reaction



Limiting Reactant: Excess Reactant:

Explanation

Topic 9: Elements and Ions to Memorize

1. Prepare flash cards for the following elements/ions and their symbols

H	hydrogen
He	helium
Li	lithium
Be	beryllium
B	boron
C	carbon
N	nitrogen
O	oxygen
F	fluorine
Ne	neon
Na	sodium
Mg	magnesium
Al	aluminum
Si	silicon
P	phosphorus
S	sulfur
Cl	chlorine
Ar	argon
K	potassium
Ca	calcium
Cr	chromium
Mn	manganese
Fe	iron
Cu	Copper
Zn	zinc
Ag	silver
Pb	lead

$C_2H_3O_2^-$	acetate
ClO_3^-	chlorate
ClO_2^-	chlorite
CN^-	cyanide
HCO_3^-	bicarbonate
OH^-	Hydroxide
NO_3^-	nitrate
NO_2^-	nitrite
ClO_4^-	perchlorate
MnO_4^-	permanganate
SCN^-	thiocyanate
CO_3^{2-}	carbonate
CrO_4^{2-}	chromate
SO_4^{2-}	sulfate
SO_3^{2-}	sulfite
PO_4^{3-}	phosphate
PO_3^{3-}	phosphite
NH_4^+	ammonium

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IONS LIST BY NAME

Acetate	$C_2H_3O_2^-$ or CH_3COO^-	Hydrogen sulfate, bisulfate	HSO_4^-	Oxide	O^{2-}
Aluminum	Al^{3+}	Hydronium	H_3O^+	Perbromate	BrO_4^-
Ammonium	NH_4^+	Hydroxide	OH^-	Perchlorate	ClO_4^-
Barium	Ba^{2+}	Hypobromite	BrO^- or OBr^-	Periodate	IO_4^-
Bromate	BrO_3^-	Hypochlorite	ClO^- or OCl^-	Permanganate	MnO_4^-
Bromide	Br^-	Hypoiodite	IO^- or OI^-	Peroxide	O_2^{2-}
Bromite	BrO_2^-	Iodate	IO_3^-	Phosphate	PO_4^{3-}
Calcium	Ca^{2+}	Iodide	I^-	Phosphite	PO_3^{3-}
Carbonate	CO_3^{2-}	Iodite	IO_2^-	Potassium	K^+
Chlorate	ClO_3^-	Iron (II), ferrous	Fe^{2+}	Silver	Ag^+
Chloride	Cl^-	Iron (III), ferric	Fe^{3+}	Sodium	Na^+
Chlorite	ClO_2^-	Lead (II), plumbous	Pb^{2+}	Strontium	Sr^{2+}
Chromate	CrO_4^{2-}	Lead (IV), plumbic	Pb^{4+}	Sulfate	SO_4^{2-}
Copper (I), cuprous	Cu^+	Lithium	Li^+	Sulfide	S^{2-}
Copper (II), cupric	Cu^{2+}	Magnesium	Mg^{2+}	Sulfite	SO_3^{2-}
Cyanide	CN^-	Mercury (I), mercurous	Hg_2^{2+}	Thiocyanate	SCN^-
Dichromate	$Cr_2O_7^{2-}$	Mercury (II), mercuric	Hg^{2+}	Thiosulfate	$S_2O_3^{2-}$
Fluoride	F^-	Nickel	Ni^{2+}	Tin (II), stannous	Sn^{2+}
Hydrogen	H^+	Nitrate	NO_3^-	Tin (IV), stannic	Sn^{4+}
Hydrogen carbonate, bicarbonate,	HCO_3^-	Nitrite	NO_2^-	Zinc	Zn^{2+}

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PRACTICE IONS QUIZ - 1

Name	Formula
Hypobromite	
Iodate	
Permanganate	
Sodium	
Ammonium	
Bisulfate	
Phosphite	
Iodite	
Silver	
Cuprous	
Phosphate	
Iodide	
Sulfite	
Lithium	
Calcium	
Sulfide	
Acetate	
Mercurous	
Bromite	
Aluminum	

Name	Formula
Hydrogen	
Thiocyanate	
Perbromate	
Nitrite	
Hypoiodite	
Nickel	
Chlorate	
Stannic	
Oxide	
Fluoride	
Cyanide	
Thiosulfate	
Hydroxide	
Mercuric	
Cupric	
Hypochlorite	
Plumbic	
Stannous	
Plumbous	
Carbonate	

Name	Formula
Dichromate	
Nitrate	
Bromate	
Bicarbonate,	
Chromate	
Hydronium	
Peroxide	
Ferric	
Chloride	
Strontium	
Periodate	
Potassium	
Chlorite	
Ferrous	
Bromide	
Perchlorate	
Sulfate	
Zinc	
Barium	
Magnesium	

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PRACTICE IONS QUIZ - 2

Name	Formula
Ferrous	
Plumbous	
Calcium	
Bromite	
Thiosulfate	
Sodium	
Chlorite	
Chromate	
Strontium	
Sulfite	
Stannous	
Hydroxide	
Nitrate	
Cyanide	
Aluminum	
Sulfide	
Bromide	
Magnesium	
Hypobromite	
Iodide	

Name	Formula
Hydronium	
Nitrite	
Iodite	
Perbromate	
Bicarbonate,	
Zinc	
Barium	
Perchlorate	
Peroxide	
Periodate	
Mercuric	
Silver	
Phosphate	
Thiocyanate	
Bromate	
Carbonate	
Bisulfate	
Chloride	
Hydrogen	
Cuprous	

Name	Formula
Iodate	
Cupric	
Phosphite	
Oxide	
Chlorate	
Hypochlorite	
Permanganate	
Dichromate	
Plumbic	
Nickel	
Mercurous	
Fluoride	
Potassium	
Sulfate	
Lithium	
Ammonium	
Acetate	
Stannic	
Hypoiodite	
Ferric	

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PRACTICE IONS QUIZ - 3

Name	Formula
Perchlorate	
Iodide	
Plumbous	
Calcium	
Thiocyanate	
Bromate	
Nitrite	
Sulfide	
Chromate	
Sulfite	
Sulfate	
Phosphate	
Phosphite	
Barium	
Sodium	
Hypoiodite	
Cupric	
Periodate	
Aluminum	
Stannous	

Name	Formula
Cuprous	
Zinc	
Perbromate	
Bicarbonate,	
Oxide	
Stannic	
Nickel	
Hydronium	
Ferrous	
Hypobromite	
Iodite	
Lithium	
Ammonium	
Strontium	
Dichromate	
Plumbic	
Acetate	
Magnesium	
Iodate	
Bromite	

Name	Formula
Mercurous	
Silver	
Thiosulfate	
Fluoride	
Ferric	
Hypochlorite	
Potassium	
Nitrate	
Peroxide	
Cyanide	
Mercuric	
Hydrogen	
Permanganate	
Chlorate	
Chloride	
Chlorite	
Carbonate	
Hydroxide	
Bisulfate	
Bromide	

Name: _____ Date: _____ PREP FOR AP CHEMISTRY

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PRACTICE IONS QUIZ - 4

Name	Formula
Aluminum	
Perbromate	
Sulfide	
Cuprous	
Nitrite	
Calcium	
Potassium	
Sulfite	
Hydroxide	
Chlorite	
Chlorate	
Zinc	
Mercuric	
Stannous	
Periodate	
Bromide	
Magnesium	
Cyanide	
Barium	
Ammonium	

Name	Formula
Sodium	
Bromite	
Lithium	
Chloride	
Thiocyanate	
Nickel	
Oxide	
Bromate	
Sulfate	
Hydronium	
Bicarbonate,	
Hydrogen	
Thiosulfate	
Silver	
Perchlorate	
Mercurous	
Iodite	
Iodate	
Hypobromite	
Plumbic	

Name	Formula
Peroxide	
Phosphate	
Hypochlorite	
Nitrate	
Phosphite	
Ferric	
Strontium	
Fluoride	
Stannic	
Chromate	
Ferrous	
Plumbous	
Carbonate	
Bisulfate	
Hypoiodite	
Permanganate	
Iodide	
Cupric	
Dichromate	
Acetate	