AP
Chemistry
Summer Assignment
2021

It is YOUR responsibility to complete this assignment!

You will be tested on your knowledge and your ability to answer/complete questions ***like*** those seen in this AP Summer Assignment Packet within the first week of school.

You will be given a Summer Assignment Review Test during the first week of school!!

Be prepared!

An answer key will be supplied on CANVAS for you to check your work the second week of August.

Dear Future AP Chemistry Students and Their Parents,

It is a pleasure to have you express an interest in taking AP Chemistry course for the upcoming school year. The College Board sponsors the Advanced Placement Program, which allows students in high school to obtain college credit and/or placement above introductory course level at the college they attend. This is a program of credit by examination. The College Board hires the Educational Testing Service (ETS) to write and grade the AP Chemistry Exams. Grades are assigned on a basis of 1-5 with a 3 as a "passing" score. Over 150,000 students worldwide took the exam last year and about 57% passed with a score of 3 or higher. It is a privilege to be a part of this beneficial program.

This privilege, however, does not mean that the road to success in this class will be easy. Both the student and the parent should not be surprised at the amount of work required for this class. It will not be unusual for you to be responsible for several assignments at one time. For example, there will be regular reading assignments and problem sets, on-line assignments, labs to write up, and time to study for tests and exams. Students should spend at least five- seven hours a week outside of class studying for this class. Also, do not be surprised if some students who are accustomed to making all A's, will suddenly begin making B's or C's on tests and start to doubt themselves, their teacher, and their decision to enter this course. You must keep in mind that you are taking a college level course with standards that are higher than usual. Students do not have to make A's on every test to do very well on the AP Exam.

It is my belief that all students who are required to take General Chemistry in college need an AP Chemistry course above all others. This belief comes from the numerous students I remain in contact with who have experienced this course in the past. It is also a well-documented fact that students having AP Chemistry in high school do much better even in higher-level chemistry courses as compared to those who take only the first year equivalent course in college. In addition to these facts, colleges are known to use the first chemistry classes to "weed" out those students who are least qualified. With these considerations in mind, it is obvious that a good preparation in high school is required and will only benefit those who choose to take this course.

Not only must AP Chemistry class provide evidence of learning chemistry concepts, it must also provide a strong laboratory component. The problem comes with sufficient time in class to incorporate the appropriate labs to reinforce these concepts. The challenge here lies in the student. It is not necessary to spend class time working out large numbers of example problems when developing a specific concept. A few types of problems can be addressed and then we move on the next topic. The course can move faster and not lose quality if more of the responsibility for learning is placed on the student. Extra class time before and/or after school and on some weekends will be a must.

Because of the vast amount of time required for this class or any other AP class, your extracurricular activities should be chosen wisely. I have known many AP Chemistry students in the past who have been involved in activities such as band, athletics, or other clubs, and have done well in the class. However, you must truly be able to budget your time and keep yourself organized. Self-discipline and self-motivation is a key part of being successful.

As you probably already know, AP Chemistry is a very challenging course with an equally challenging AP test. The material is detailed and we have several topics to cover. You will need to refresh your memory on information that was taught in prior Chemistry classes so that we can move on to expand on your knowledge base.

Your goal should be to complete the summer assignment and email questions as they arise. We will reinforce this review with some lab activities during the beginning of the semester. We will have an exam on the first day of class on items that are to be memorized and the first three chapters of the text.

The course will move on from the initial review into more advanced studies of first year college chemistry. The topics will build upon your knowledge from prior Chemistry classes and cover more application and detail. You will begin to place the pieces together in the jigsaw puzzle called Chemistry.

Mr. Wolff

Task 1: Memorize the names of the elements and their corresponding symbols

- You need to know elements 1-56, plus Pt, Au, Hg, Pb, Rn, Fr, Ra, U, Pu
- Many of these elements you will already know
- Making flashcards is helpful!
- It's important to know these elements because the periodic table you are provided has only the symbols and not the names of the elements.

Task 2: Memorize the ionic charges of the basic ions

- Think about the valance electrons!
- Think about the common elements/ions in that group

Group 1 ions = +1

Group 2 ions = +2

Group 15 (5A) ions (N and P) = -3

Group 16 (6A) ions (O and S) = -2

Group 17 (7A)/ halogens = -1

(Zn = +2 Ag = +1 Cu = +1 or +2 Fe = +2 or +3 Pb = +2 or +4 Sn=+2 or +4)

Task 3: Memorize the names, symbols, and charges of Polyatomic ions below:

- Oxyanions – polyatomics containing oxygen, names end in –ate or –ite
- -ate is used for the most common form
- -ite is used for the form with the same charge, but one less oxygen

  (Examples: NO_3^- = nitrate NO_2^- = nitrite)
- Prefixes are also used

Per- indicates one more oxygen than the –ate form

Hypo- indicates one fewer oxygen than the –ite form

Examples: ClO_4^- = perchlorate (b/c it has one more O than the –ate form)

ClO_3^- = chlorate (b/c it is the most common)

ClO_2^- = chlorite (b/c it has one less oxygen than – ate form)

ClO_4^- = hypochlorite (b/c it has one less oxygen than the –ite form)

Hydrogen can be added to -2 or -3 ions to make a "new ion" i.e. $H_2PO_4^{-1}$ is dihydrogen phosphate (note the – charge went up 1 for each H^+ added)

This Periodic Table is the one that is used during an AP Exam. Notice that it does not include the elements' name as you are expected to get familiar with them and their correct symbols.

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 (266)	107 Bh (264)	108 Hs (277)	109 Mt (268)	110 Ds (271)	111 Rg (272)							

* Lanthanides	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
† Actinides	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np (237)	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 (262)

Significant Figures in Measurement and Calculations

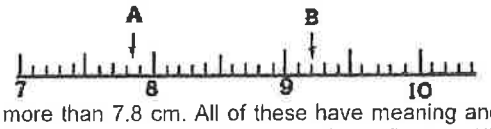
A successful chemistry student habitually labels all numbers, because the unit is important. Also of great importance is the number itself. Any number used in a calculation should contain only figures that are considered reliable; otherwise, time and effort are wasted. Figures that are considered reliable are called *significant figures*. Chemical calculations involve numbers representing actual measurements. In a measurement, significant figures in a number consist of:

Figures (digits) definitely known + One estimated figure (digit)

In class you will hear this expressed as "all of the digits known for certain plus one that is a guess."

Recording Measurements

When one reads an instrument (ruler, thermometer, graduate, buret, barometer, balance), he expresses the reading as one which is reasonably reliable. For example, in the accompanying illustration, note the reading marked *A*. This reading is definitely beyond the 7 cm mark and also beyond the 0.8 cm mark. We read the 7.8 with certainty. We further *estimate* that the reading is five-tenths the distance from the 7.8 mark to the 7.9 mark. So, we estimate the length as 0.05 cm more than 7.8 cm. All of these have meaning and are therefore significant. We express the reading as 7.85 cm, accurate to three significant figures. All of these figures, *7.85*, can be used in calculations. In reading B we see that 9.2 cm is definitely known. We can include one estimated digit in our reading, and we estimate the next digit to be zero. Our reading is reported as 9.20 cm. It is accurate to three significant figures.



Rules for Zeros

If a zero represents a measured quantity, it is a significant figure. If it merely locates the decimal point, it is not a significant figure.

Zero Within a Number. In reading the measurement 9.04 cm, the zero represents a measured quantity, just as 9 and 4, and is, therefore, a significant number. A zero between any of the other digits in a number is a significant figure.

Zero at the Front of a Number. In reading the measurement 0.46 cm, the zero does not represent a measured quantity, but merely locates the decimal point. It is not a significant figure. Also, in the measurement 0.07 kg, the zeros are used merely to locate the decimal point and are, therefore, not significant. Zeros at the first (left) of a number are not significant figures.

Zero at the End of a Number. In reading the measurement 11.30 cm, the zero is an estimate and represents a measured quantity. It is therefore significant. Another way to look at this: The zero is not needed as a placeholder, and yet it was included by the person recording the measurement. It must have been recorded as a part of the measurement, making it significant. Zeros to the right of the decimal point, and at the end of the number, are significant figures.

Zeros at the End of a Whole Number. Zeros at the end of a whole number may or may not be significant. If a distance is reported as 1600 feet, one assumes two sig figs. Reporting measurements in scientific notation removes all doubt, since all numbers written in scientific notation are considered significant.

1 600 feet	1.6×10^3 feet	Two significant figures
1 600 feet	1.60×10^3 feet	Three significant figures
1 600 feet	1.600×10^3 feet	Four significant figures

Sample Problem #1: Underline the significant figures in the following numbers.

(a) 0.0420 cm	answer = 0.0420 cm	(e) 2 403 ft.	answer = 2 403 ft.
(b) 5.320 in.	answer = 5.320 in.	(f) 80.5300 m	answer = 80.5300 m
(c) 10 lb.	answer = 10 lb.	(g) 200. g	answer = 200. g
(d) 0.020 ml	answer = 0.020 ml	(h) 2.4×10^3 kg	answer = 2.4×10^3 kg

Rounding Off Numbers

In reporting a numerical answer, one needs to know how to "round off" a number to include the correct number of significant figures. Even in a series of operations leading to the final answer, one must "round off" numbers. The rules are well accepted rules:

1. If the figure to be dropped is less than 5, simply eliminate it.
2. If the figure to be dropped is greater than 5, eliminate it and raise the preceding figure by 1.
3. If the figure is 5, followed by nonzero digits, raise the preceding figure by 1
4. If the figure is 5, not followed by nonzero digit(s), and preceded by an odd digit, raise the preceding digit by one
5. If the figure is 5, not followed by nonzero digit(s), and the preceding significant digit is even, the preceding digit remains unchanged

Sample Problem #2: Round off the following to three significant figures.

(a) 3.478 m	answer = 3.48 m	(c) 5.333 g	answer = 5.33 g
(b) 4.8055 cm	answer = 4.81 cm	(d) 7.999 in.	answer = 8.00 in.

Multiplication

In multiplying two numbers, when you wish to determine the number of significant figures you should have in your answer (the product), you should inspect the numbers multiplied and find which has the least number of significant figures. This is the number of significant figures you should have in your answer (the product). Thus the answer to 0.024 x 1244 would be rounded off to contain two significant figures since the factor with the lesser number of significant figures (0.024) has only *two* such figures.

Sample Problem #3: Find the area of a rectangle 2.1 cm by 3.24 cm.

Solution: Area = 2.1 cm x 3.24 cm = 6.804 cm^2

We note that 2.1 contains two significant figures, while 3.24 contains three significant figures. Our product should contain no more than *two* significant figures. Therefore, our answer would be recorded as 6.8 cm^2

Sample Problem #4: Find the volume of a rectangular solid 10.2 cm x 8.24 cm x 1.8 cm

Solution: Volume = 10.2 cm x 8.24 cm x 1.8 cm = 151.2864 cm^3

We observe that the factor having the least number of significant figures is 1.8 cm. It contains two significant figures. Therefore, the answer is rounded off to 150 cm^3.

Division

In dividing two numbers, the answer (quotient) should contain the same number of significant figures as are contained in the number (divisor or dividend) with the least number of significant figures. Thus the answer to 528 ÷ 0.14 would be rounded off to contain *two* significant figures. The answer to 0.340 ÷ 3242 would be rounded off to contain three significant figures.

Sample Problem #5: Calculate 20.45 ÷ 2.4

Solution: 20.45 ÷ 2.4 = 8.52083

We note that the 2.4 has fewer significant figures than the 20.45. It has only *two* significant figures. Therefore, our answer should have no more than two significant figures and should be reported as 8.5.

Addition and Subtraction

In adding (or subtracting), set down the numbers, being sure to keep like decimal places under each other, and add (or subtract). Next, note which column contains the first estimated figure. This column determines the last decimal place of the answer. After the answer is obtained, it should be rounded off in this column. In other words, round to the least number of decimal places in you data.

Sample Problem #6: Add 42.56 g + 39.460 g + 4.1g

Solution:

42.56 g
39.460 g
4.1 g
Sum = 86.120 g

Since the number 4.1 only extends to the first decimal place, the answer must be rounded to the first decimal place, yielding the answer 86.1 g.

Average Readings

The average of a number of successive readings will have the same number of decimal places that are in their sum.

Sample Problem #7: A graduated cylinder was weighed three times and the recorded weighings were 12.523 g, 12.497 g, 12.515 g. Calculate the average weight.

Solution:

12.523 g
12.497 g
12.515 g
37.535 g

In order to find the average, the sum is divided by 3 to give an answer of 12.51167. Since each number extends to three decimal places, the final answer is rounded to three decimal places, yielding a final answer of 12.512 g. Notice that the divisor of 3 does not effect the rounding of the final answer. This is because 3 is an exact number - known to an infinite number of decimal places.

ASSIGNMENT 1: SCIENTIFIC NOTATION, SIG. FIGS., DENSITY

Change to scientific notation.

a. 5.420×10^{3} = _____ d. 0.0067×10^{-4} = _____

b. 0.020×10^{3} = _____ e. -870×10^{-4} = _____

c. 0.00492×10^{12} = _____ f. -602×10^{21} = _____

Determine the number of sig. figs. in the following:

a. 0.002030 = _____ s.f.

b. 670.0 = _____ s.f.

c. 4×10^{2} = _____ s.f.

d. 4640 = _____ s.f.

e. 670 = _____ s.f.

f. 1.35000 = _____ s.f.

g. 4.00×10^{2} = _____ s.f.

h. 0.060×10^{3} = _____ s.f

Perform the following calculations. Report your answer in correct number of sig.figs. and units.

a. 1.008 m + 32.00 m + 2.2 m = _____

b. 17.65 g – 9.7 g = _____

c. $2.03\ cm^{2} \div 1.2\ cm$ = _____

d. 13.8612 cm x 2.02 cm = _____

e. $5.60 \times 10^{-2}\ \frac{s}{s} \cdot 0.090\ s^{-3}$ = _____

LL+gg

Give the number of significant figures in each of the following:

____ 402 m	____ 34.20 lbs	____ 0.03 sec
____ 0.00420 g	____ 3 200 liters	____ 0.0300 ft.
____ 5.1×10^4 kg	____ 0.48 m	____ 1 400.0 m
____ 78 323.01 g	____ 1.10 torr	____ 760 mm Hg

Multiply each of the following, observing significant figure rules:

17 m x 324 m = _____ 1.7 mm x 4 294 mm = _____

0.005 in x 8 888 in = _____ 0.050 m x 102 m = _____

0.424 in x .090 in = _____ 324 000 cm x 12.00 cm = _____

Divide each of the following, observing significant figure rules:

23.4 m ÷ 0.50 sec = _____ 12 miles ÷ 3.20 hours = _____

0.960 g ÷ 1.51 moles = _____ 1 200 m ÷ 12.12 sec = _____

Add each of the following, observing significant figure rules:

3.40 m	102.45 g	102. cm
0.022 m	2.44 g	3.14 cm
0.5 m	1.9999 g	5.9 cm

Subtract each of the following, observing signigicant figure rules:

42.306 m	14.33 g	234.1 cm
1.22 m	3.468 g	62.04 cm

Work each of the following problems, observing significant figure rules:

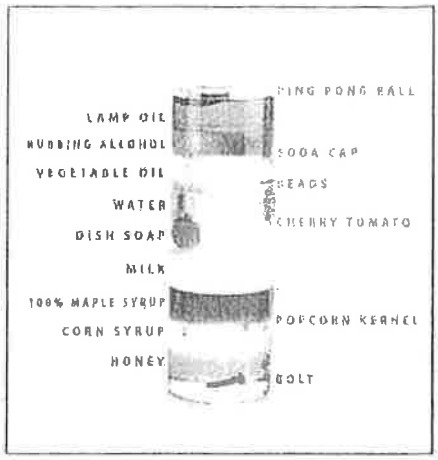
Three determinations were made of the percentage of oxygen in mercuric oxide. The results were 7.40%, 7.43%, and 7.35%. What was the average percentage?

A rectangular solid measures 13.4 cm x 11.0 cm x 2.2 cm. Calculate the volume of the solid.

If the density of mercury is 13.6 g/ml, what is the mass in grams of 3426 ml of the liquid?

A copper cylinder, 12.0 cm in radius, is 44.0 cm long. If the density of copper is 8.90 g/cm^3, calculate the mass in grams of the cylinder. (assume pi = 3.14)

4. Write at least 7 facts describing/explaining the Chemistry behind the picture on the right.



5. A 12.00 g unknown substance is placed in a container with 50.0 mL water. The water level rose up to 55.2 mL. Calculate the density of the substance.

6. Draw/illustrate how the following substances will appear inside a graduated cylinder just like in #4.

Liquid 1 (0.69 g/mL)	Solid 1 (0.89 g/mL)
Liquid 2 (1.26 g/mL)	Solid 2 (2.04 g/mL)
Liquid 3 (water)	Liquid 4 (3.05 g/mL)

ASSIGNMENT 2: FORMULA WRITING, NAMING OF COMPOUNDS & BALANCING CHEMICAL EQUATIONS

(Refer to the Periodic Table included in this packet as well as the list of polyatomic ions given in Assignment 5.)

1. Name the following ionic compounds:

   a. $LiCl$ –

   b. $Mg(OH)_2$ –

   c. K_3P –

   d. Fe_2O_3 –

   e. FeO –

   f. $ZnCl_2$ –

   g. $AgNO_3$ –

   h. NH_4Cl –

   i. $CuCl_2$ –

   j. $SnCl_2$ –

   k. PbO_2 –

   l. $AlCl_3$ –

   m. $PbSO_4$ –

   n. $Mg_3(PO_3)_2$ –

   o. Na_2CO_3 –

   p. $NaHCO_3$ –

2. Write ionic formulas for the following compounds:

   a. sodium acetate -

   b. tin(II) chloride -

   c. calcium hydroxide -

   d. zinc sulfite -

   e. ammonium sulfate -

   f. manganese(II) hypochlorite -

   g. copper (I) nitrite -

   h. silver cyanide -

   i. sodium chloride -

   j. lithium fluoride -

   k. potassium sulfide -

   l. aluminum oxide -

   m. nickel (II) chlorite -

   n. lead (II) nitrate

   0. ammonium sulfate -

   p. aluminum perchlorate -

q. KCN –

r. $KMnO_4$-

s. FeC_2O_4 –

t. $Al(ClO)_3$ –

u. FeS_2O_3 –

v. $Sn(CrO_4)_2$ –

w. $Mg(HSO_4)_2$ –

q. iron (II) dichromate -

r. lead (IV) bromite -

s. lead (II) periodate -

t. magnesium thiocyanate -

u. calcium thiosulfate -

v. sodium bicarbonate -

w. strontium hydroxide -

3. Name the following covalent compounds:

a. CO –

b. CO_2 –

c. H_2O –

d. CCl_4 –

e. N_2O_3 –

f. SiO_2 –

g. N_2O –

h. CBr_4 –

i. SO_2 –

j. S_2Cl_2 –

k. P_2O_7 –

4. Write the molecular formula for the following compounds:

a. xenon hexafluoride -

b. tetranitrogen tetraoxide-

c. boron trifluoride -

d. carbon tetrabromide -

e. dicarbon tetrafluoride -

f. nitrogen tribromide -

g. dinitrogen tetrasulfide -

h. oxygen difluoride -

i. dinitrogen pentoxide -

j. tetraphosphorus decoxide -

k. sulfur hexafluoride -

5. Translate the following word equations to a balanced chemical equations.

   a. iron (II) oxide + aluminum → iron + aluminum oxide

   b. hydrochloric acid + sodium hydroxide → water + sodium chloride

   c. calcium phosphate + sulfuric acid → calcium sulfate + phosphoric acid

   d. calcium carbonate → calcium + carbon + oxygen gas

   e. sodium chloride + silver nitrate → sodium nitrate + silver chloride

   f. potassium hydroxide + sulfuric acid → potassium sulfate + water

6. Identify each of the equations you balanced in #5 as **reduction-oxidation**, **precipitation** or **acid-base (neutralization)** reactions.

   a.
   b.
   c.
   d.
   e.
   f.

ASSIGNMENT 3: MOLES ↔ GRAMS, MOLARITY, AND STOICHIOMETRY

a. *Use the Periodic Table included in this packet for the atomic masses.* ***Do not*** *round the atomic masses.*
b. *Show cancellation of units and report the final answer with the correct unit and correct number of sig figs.*

1. Convert the following to moles :
   a. 36.85 g C = _____
   b. 170 g O_2 = _____
   c. 24.0 g Cu = _____
   d. 165.02 g H_2O = _____
   e. 320.0 g $CaCO_3$ = _____
   f. 50.020 g $Ca_3(PO_4)_2$ = _____

2. Convert the following to grams:
   a. 1.20 mol H_2 = _____
   b. 0.052 mol Ca = _____
   c. 10.0 mol CO_2 = _____
   d. 0.00650 mol $AgNO_3$ = _____
   e. 1.025 mole $Al_2(SO_4)_3$ = _____

3. Find the concentration in molarity (M) of the following solutions:

   a. 25.0 g HCl in 2.1 L solution

   b. 42.2 g KOH in 250 mL solution

   c. 0.065 kg $Ba(OH)_2$ in 350 mL solution

4. Find the number of moles of solute present in the following solutions:

   a. 1.20 L of 0.25M H_2SO_4 solution

   b. 0.520 L of 1.2M $CuSO_4$ solution

   c. 650.0 mL of 0.21M KNO_3 solution

5. Solve the following stoichiometric problems completely.

   a. Air bags in cars operate according to the reaction:

$$2\ Na_3N_{(s)} \rightarrow 6\ Na_{(s)} + N_{2(g)}$$

   How many grams of nitrogen gas are produced during the decomposition of 3.25 g Na_3N ?

b. How many grams of lithium are needed to produce 45.0 g of lithium nitride, according to the following process?

$$6\ Li_{(s)} + N_{2(g)} \rightarrow 2\ Li_3N_{(s)}$$

c. A 24.5g sample of sodium chloride reacts with 41.3 g of fluorine gas according to the following chemical equation:

$$2\ NaCl_{(s)} + F_{2(g)} \rightarrow 2\ NaF_{(s)} + Cl_{2(g)}$$

c.1 Which is the limiting reactant? Justify your answer with calculations.

c.2 How many grams of chlorine gas are produced?

d. An 84.1 gram sample of phosphorus reacts with 85.0 g of oxygen according to the following equation:

$$4\ P_{(s)} + 5\ O_{2(g)} \rightarrow 2\ P_2O_{5(s)}$$

d.1 Find the limiting reactant. Justify your answer with calculations.

d.2 How many grams of P_2O_5 are produced in theory ? (based on calculation)

d.3 A student performed the reaction in the lab and found out that only 123 g of P_2O_5 were produced. What then is the percent yield for P_2O_5 ?

ASSIGNMENT 4: GAS LAWS

1. Write down what the following gas laws state and their respective equations.

   a. Boyle's Law : _____

      Equation :

   b. Charles' Law : _____

      Equation :

   c. Gay-Lussac's Law : _____

      Equation :

   d. Combined Gas Law : _____

      Equation :

   e. Avogadro's Law : _____

      Equation :

   f. Ideal Gas Law : _____

      Equation :

2. WORD PROBLEMS:

a. *Use the G-U-E-S-S method (**G**iven, **U**nknown, **E**quation, **S**ubstitution, **S**olution) in solving the following problems. Identify and write down the specific gas law involved before solving each problem.*

b. *Identify the physical quantity of each Given (i.e. pressure, volume, temperature, moles) and the Unknown in the problem.*

c. *Show cancellation of units and report the final answer with the correct unit and correct number of sig figs. Always use the **Kelvin** unit for temperature.*

Useful Information:

$$1 \text{ atm} = 760 \text{ mm Hg} = 101.3 \text{ kPa}$$

$$R = \text{ideal gas constant} = 0.0821 \frac{L \cdot atm}{mol \cdot K} = 8.31 \frac{L \cdot kPa}{mol \cdot K} = 62.4 \frac{L \cdot mm Hg}{mol \cdot K}$$

standard temperature and pressure (STP) = 0°C and 1 atm

0°C = 273 K

2.1

A 100.0 L sample of gas was compressed to 10.0 mL where its pressure is 350.0 torr. What was the original pressure (in torr) of the 100.0 L sample?

2.2

Butane gas is stored in a tank at a pressure of 10.0 atm at 22.0°C. The tank can hold a pressure of 50.0 atm before bursting. During a fire the gas is heated to 500.0°C. What is the gas pressure, and will the tank contain the gas without bursting?

2.3

Calculate the volume in liters of 38.8 g of CO_2 at 725 torr and 25.0°C

2.4

A gas occupies 450.0 mL at 655 mm Hg pressure and 30.0°C. What will its volume be at STP?

2.5

On hot days, you may have noticed that potato chip bags seem to "inflate", even though they have not been opened. If I have a 250.0 mL bag at a temperature of 19.0^{0}C, and I leave it in my car which has a temperature of 60.0^{0}C, what will the new volume of the bag be?

Assignment 5: Common Ions and 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 second day of class, when I will give you a quiz on them.** You will always be allowed a periodic table, which makes identifying the ions on the left "automatic." For tips on learning these ions, see the next page.

From the table:	
Cations	Name
H^+	Hydrogen
Li^+	Lithium
Na^+	Sodium
K^+	Potassium
Rb^+	Rubidium
Cs^+	Cesium
Be^{2+}	Beryllium
Mg^{2+}	Magnesium
Ca^{2+}	Calcium
Ba^{2+}	Barium
Sr^{2+}	Strontium
Al^{3+}	Aluminum
Anions	Name
H^-	Hydride
F^-	Fluoride
Cl^-	Chloride
Br^-	Bromide
I^-	Iodide
O^{2-}	Oxide
S^{2-}	Sulfide
Se^{2-}	Selenide
N^{3-}	Nitride
P^{3-}	Phosphide
As^{3-}	Arsenide
Type II Cations	Name
Fe^{3+}	Iron(III)
Fe^{2+}	Iron(II)
Cu^{2+}	Copper(II)
Cu^+	Copper(I)
Co^{3+}	Cobalt(III)
Co^{2+}	Cobalt(II)
Sn^{4+}	Tin(IV)
Sn^{2+}	Tin(II)
Pb^{4+}	Lead(IV)
Pb^{2+}	Lead(II)
Hg^{2+}	Mercury(II)

Ions to Memorize	
Cations	Name
Ag^+	Silver
Zn^{2+}	Zinc
Hg_2^{2+}	Mercury(I)
NH_4^+	Ammonium
Anions	Name
NO_2^-	Nitrite
NO_3^-	Nitrate
SO_3^{2-}	Sulfite
SO_4^{2-}	Sulfate
HSO_4^-	Hydrogen sulfate (bisulfate)
OH^-	Hydroxide
CN^-	Cyanide
PO_4^{3-}	Phosphate
HPO_4^{2-}	Hydrogen phosphate
$H_2PO_4^-$	Dihydrogen phosphate
NCS^-	Thiocyanate
CO_3^{2-}	Carbonate
HCO_3^-	Hydrogen carbonate (bicarbonate)
ClO^-	Hypochlorite
ClO_2^-	Chlorite
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
$C_2H_3O_2^-$	Acetate
MnO_4^-	Permanganate
$Cr_2O_7^{2-}$	Dichromate
CrO_4^{2-}	Chromate
O_2^{2-}	Peroxide
$C_2O_4^{2-}$	Oxalate
NH_2^-	Amide
BO_3^{3-}	Borate
$S_2O_3^{2-}$	Thiosulfate

Tips for Learning the Ions

"From the Table"

These are ions can be organized into two groups.

1. 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.
    a. All Group 1 Elements (alkali metals) lose one electron to form an ion with a 1+ charge
    b. All Group 2 Elements (alkaline earth metals) lose two electrons to form an ion with a 2+ charge
    c. Group 13 metals like aluminum lose three electrons to form an ion with a 3+ charge
    d. All Group 17 Elements (halogens) gain one electron to form an ion with a 1- charge
    e. All Group 16 nonmetals gain two electrons to form an ion with a 2- charge
    f. All Group 15 nonmetals gain three electrons to form an ion with a 3- charge

    Notice that cations keep their name (sodium ion, calcium ion) while anions get an "-ide" ending (chloride ion, oxide ion).

2. 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

Polyatomic Anions

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.
    a. sulfate is SO_4^{2-}, so sulfite has the same charge but one less oxygen (SO_3^{2-})

    b. nitrate is NO_3^-, so nitrite has the same charge but one less oxygen (NO_2^-)

2. If you know that a sufate 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.
    a. Example:

PO_4^{3-}	HPO_4^{2-}	$H_2PO_4^-$
phosphate	hydrogen phosphate	dihydrogen phosphate

3. Learn the hypochlorite chlorite chlorate perchlorate series, and you also know the series containing iodite/iodate as well as bromite/bromate.
    a. The relationship between the "ite" and "ate" ion is predictable, as always. Learn one and you know the other.
    b. The prefix "hypo" means "under" or "too little" (think "hypodermic", "hypothermic" or "hypoglycemia")
        i. Hypochlorite is "under" chlorite, meaning it has one less oxygen
    c. The prefix "hyper" means "above" or "too much" (think "hyperkinetic")
        i. the prefix "per" is derived from "hyper" so perchlorate (hyperchlorate) has one more oxygen than chlorate.
    d. Notice how this sequence increases in oxygen while retaining the same charge:

ClO^-	ClO_2^-	ClO_3^-	ClO_4^-
hypochlorite	chlorite	chlorate	perchlorate