

AP Chemistry Summer Assignment 2019

Ms. Wong

Welcome to AP Chemistry! You already have a background in chemistry from General Chemistry class, now you will use that knowledge as the foundation to learn the AP Chemistry concepts. A big part of your success in AP Chemistry is your commitment to the course and willingness to put forth your best effort outside of class. In order to keep the chemistry basics fresh in your mind and be prepared for AP Chemistry this fall, you must complete the following assignment over your summer break. The assignment consists of three parts.

- Part 1 – Sign-up for Remind text alerts and submit student survey by July 31
- Part 2 – Study the Common Ions
- Part 3 – Complete the *recommended* Review Worksheets. The Review Worksheets will not be collected or graded. They are provided so that you know what skills and concepts we will be building upon during our first unit of study next year. Even though I am not grading the Review Worksheets, I strongly recommend that you complete them to the best of your ability. The answer key will be uploaded on the class website for you to self-check your answers.

Important Dates

- July 31 – register for Remind text alerts. Complete and submit online AP Chemistry Student Survey.
- Week of August 12 – our first study session. I will host a review session at school. This review session is intended to jog your memory about Gen Chem concepts like naming compounds, unit conversions, stoichiometry, etc. This is an optional study session, but again highly recommended. An announcement will be sent via Remind and posted on the class website with the specific date, time, and location.
- Third Day of Class – Quiz on common ions.

You may reference the class website: www.wongchemistry.weebly.com for resources and class updates. You might find the Gen Chem resources particularly helpful. Should you have any questions, I will be checking my email frequently throughout the summer. I can be reached at: megan.wong@vbschools.com

Have a great summer!

Ms. Wong

Part 1: Remind Registration & Student Survey

How to Register for Remind:

1. Text the message @apchemsum to the number 81010
2. If you experience difficulty texting 81010, then try texting @apchemsum to (571) 292-3625

How to Complete the Student Survey:

1. Go to the class website www.wongchemistry.weebly.com
2. Under the AP Chemistry tab, click AP Chem Summer Assignment.
3. Scroll down and click the link for the student survey.
4. Complete the survey and submit your information.

Part 2: Common Ions

You need to master the formulas, charges, and names of the common ions. On the third day of class, there will be a quiz on these ions. You will be asked to:

- Write the names of these ions when given the formula and charge
- Write the formula and charge when given the names

Included in this packet are several resources to help you learn and remember these ions.

1. Tips for Learning the Ions – helpful hints to help you memorize the ions
2. List of ions and names you must know. Making and studying flashcards will help you memorize these ions.
3. AP Chemistry periodic table – notice names of elements are not provided

Part 3: Review Worksheets

Complete the *recommended* (i.e. optional) Review Worksheets #1 and #2. Worksheets are provided so that you can review basic chemistry. The answer key will be posted on the class website under the AP Chemistry tab, Summer Assignment.

PERIODIC TABLE OF THE ELEMENTS

1 H 1.008																	2 He 4.00
3 Li 6.94	4 Be 9.01															9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.30															17 Cl 35.45	18 Ar 39.95
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 54.94	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)							

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
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)

*Lanthanide Series

†Actinide Series

Common Ions

[illegible]

Ions to Memorize	
Cations	Name
Ag^+	Silver
Zn^{2+}	Zinc
Cd^{2+}	Cadmium
Hg_2^{2+}	Mercury (I)
NH_4^+	Ammonium
1- Polyatomic Anions	Name
NO_2^-	Nitrite
NO_3^-	Nitrate
OH^-	Hydroxide
CN^-	Cyanide
HSO_4^-	Hydrogen sulfate (bisulfate)
H_2PO_4^-	Dihydrogen phosphate
HCO_3^-	Hydrogen carbonate (bicarbonate)
SCN^-	Thiocyanate
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
$\text{C}_2\text{H}_3\text{O}_2^-$	Acetate
MnO_4^-	Permanganate
NH_2^-	Amide
2- Polyatomic Anions	Name
SO_3^{2-}	Sulfite
SO_4^{2-}	Sulfate
HPO_4^{2-}	Hydrogen phosphate
CO_3^{2-}	Carbonate
CrO_4^{2-}	Chromate
$\text{Cr}_2\text{O}_7^{2-}$	Dichromate
O_2^{2-}	Peroxide
$\text{S}_2\text{O}_3^{2-}$	Thiosulfate
$\text{C}_2\text{O}_4^{2-}$	Oxalate
SiO_3^{2-}	Silicate
SeO_4^{2-}	Selenate
3- Polyatomic Anions	Name
PO_4^{3-}	Phosphate
BO_3^{3-}	Borate

Tips for Learning the Ions

"From the Table"

These 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).

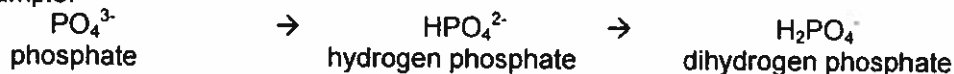
2. Metals that can form more than one ion will have their positive charge denoted by a roman numeral in parenthesis immediately next to the name of the metal.

Polyatomic Anions

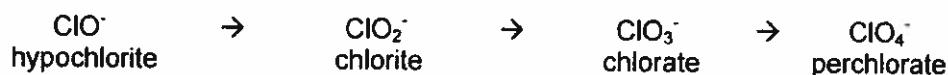
Most of the work on memorization occurs with these ions, but there are a number of patterns that can greatly reduce the amount of memorizing that one must do.

1. "ate" anions have one more oxygen than 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 sulfate 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:



3. Learn the hypochlorite \rightarrow chlorite \rightarrow chlorate \rightarrow 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:



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 = 0.0 <u>420</u> cm	(e) 2 403 ft.	answer = <u>2 403</u> ft.
(b) 5.320 in.	answer = <u>5.320</u> in.	(f) 80.5300 m	answer = <u>80.5300</u> m
(c) 10 lb.	answer = <u>10</u> lb.	(g) 200. g	answer = <u>200</u> g
(d) 0.020 ml	answer = 0.0 <u>20</u> ml	(h) 2.4×10^3 kg	answer = <u>2.4</u> $\times 10^3$ 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 0.024×1244 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 = $2.1 \text{ cm} \times 3.24 \text{ cm} = 6.804 \text{ cm}^2$

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 = $10.2 \text{ cm} \times 8.24 \text{ cm} \times 1.8 \text{ cm} = 151.2864 \text{ cm}^3$

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 $528 \div 0.14$ would be rounded off to contain *two* significant figures. The answer to $0.340 \div 3242$ would be rounded off to contain three significant figures.

Sample Problem #5: Calculate $20.45 \div 2.4$

Solution: $20.45 \div 2.4 = 8.52083$

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 your data.

Sample Problem #6: Add $42.56 \text{ g} + 39.460 \text{ g} + 4.1 \text{ g}$

Solution:

	42.56 g
	39.460 g
	<u>4.1 g</u>
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
<u>12.515 g</u>
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.

Name: _____
AP Chemistry Summer Assignment

Date: _____

Worksheet #1 - Math Skills

Significant Figures (Sig Figs)

1. How many sig figs are in the following numbers?

a) 0.0450 _____

b) 790 _____

c) 32.10 _____

2. Solve the following problems. Round your answer to the correct number of sig figs (and use the correct unit on your answer).

a) $825\text{ cm} \times 32\text{ cm} \times 0.248\text{ cm}$ _____

b) $\frac{15.68\text{ g}}{2.885\text{ mL}}$ _____

Density (round your answers to correct number of sig figs and show all work with units)

3. A cube of ruthenium metal 1.5 cm on a side has a mass of 42.0 g. What is the density in g/cm^3 ? Will ruthenium metal float on water?

4. The density of bismuth metal is 9.8 g/cm^3 . What is the mass of a sample of bismuth that displaces 65.8 mL of water?

Conversions (round answers correctly and show work with units)

5. Make the following conversions:

a) 16.2 m to km

b) 5.44 nL to mL

c) 45.7 mL/s to kL/hr

Reactions

6. Balance the following and equations and tell what type of reaction it is (synthesis, decomposition, single replacement, double replacement, or combustion)

a) $\text{___ KNO}_3 \rightarrow \text{___ KNO}_2 + \text{___ O}_2$ Type: _____

b) $\text{___ AgNO}_3 + \text{___ K}_2\text{SO}_4 \rightarrow \text{___ Ag}_2\text{SO}_4 + \text{___ KNO}_3$ Type: _____

c) $\text{___ CH}_3\text{NH}_2 + \text{___ O}_2 \rightarrow \text{___ CO}_2 + \text{___ H}_2\text{O} + \text{___ N}_2$ Type: _____

d) $\text{___ N}_2\text{O}_5 + \text{___ H}_2\text{O} \rightarrow \text{___ HNO}_3$ Type: _____

e) $\text{___ Na} + \text{___ Zn(NO}_3)_2 \rightarrow \text{___ Zn} + \text{___ NaNO}_3$ Type: _____

7. What are diatomic molecules? List the 7.

Average Atomic Mass

8. Magnesium consists of 3 naturally occurring isotopes with the masses 23.98504, 24.98584, and 25.98259 amu. The relative abundances of these three isotopes are 78.70%, 10.13 %, and 11.17% respectively. Calculate the average atomic mass.

Percent Composition

9. Calculate the percent composition of $C_{12}H_{22}O_{11}$ (sugar). (Give Percent of each element.) Show all work.

Moles

10. Calculate the number of moles of the following: (SHOW WORK)

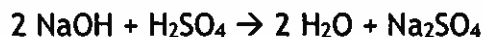
a) 42.8 g of KNO_3

b) 155.7 L of CO_2 at STP

c) 9.25×10^{26} molecules of $CaCl_2$

Stoichiometry

11. Using the following equation:



How many grams of sodium sulfate will be formed if you start with 200 grams of sodium hydroxide and you have an excess of sulfuric acid?

12. Using the following equation:



How many grams of lithium nitrate will be needed to make 250 grams of lithium sulfate, assuming that you have an adequate amount of lead (IV) sulfate to do the reaction?

13. Using the following equation: $\text{Fe}_2\text{O}_3 + 3 \text{H}_2 \rightarrow 2 \text{Fe} + 3 \text{H}_2\text{O}$

Calculate how many grams of iron can be made from 16.5 grams of Fe_2O_3 .

Limiting Reactant & Percent Yield

1. Determine the grams of sodium chloride produced when 10.0 g of sodium react with 10.0 g of chlorine gas according to the equation: $2 \text{ Na} + \text{Cl}_2 \rightarrow 2 \text{ NaCl}$
2. Determine the mass of lithium hydroxide produced when 50.0g of lithium are reacted with 45.0g of water according to the equation: $2 \text{ Li} + 2 \text{ H}_2\text{O} \rightarrow 2 \text{ LiOH} + \text{H}_2$
3. Determine the percent yield of water produced when 68.3 g of hydrogen reacts with 85.4g of oxygen and 86.4g of water are collected. $2 \text{ H}_2 + \text{O}_2 \rightarrow 2 \text{ H}_2\text{O}$

Worksheet #2: Practice Naming Compounds

1. Provide names for the following ionic compounds:

- a. AlF_3 _____
- b. $\text{Fe}(\text{OH})_2$ _____
- c. $\text{Cu}(\text{NO}_3)_2$ _____
- d. $\text{Ba}(\text{ClO}_4)_2$ _____
- e. Li_3PO_4 _____
- f. Hg_2S _____
- g. $\text{Cr}_2(\text{CO}_3)_3$ _____
- h. $(\text{NH}_4)_2\text{SO}_4$ _____

2. Write the chemical formulas for the following compounds:

- a. Copper(I) oxide _____
- b. Potassium peroxide _____
- c. Iron(III) carbonate _____
- d. Zinc nitrate _____
- e. Sodium hypobromite _____
- f. Aluminum hydroxide _____

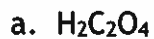
3. Give the name or chemical formula for each of the following molecular substances:

- a. SF_6 _____
- b. XeO_3 _____
- c. Dinitrogen tetroxide _____
- d. Hydrogen cyanide _____
- e. IF_5 _____
- f. Dihydrogen monoxide _____
- g. Tetraphosphorous hexasulfide _____

4. Give the name or chemical formula for the following compounds:

- a. Ammonium oxalate _____
- b. Manganese(III) dichromate _____
- c. $\text{Ti}(\text{OH})_4$ _____
- d. $\text{Ni}(\text{ClO}_2)_3$ _____
- e. Dinitrogen pentoxide _____
- f. Aluminum oxide _____
- g. Fe_2S_3 _____

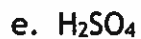
5. Name the following acids













6. Write formulas for the following acids.

a. hydrochloric acid

b. sulfuric acid

c. nitric acid

d. phosphoric acid

e. carbonic acid

f. acetic acid
