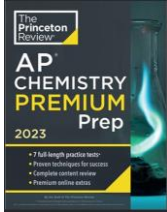
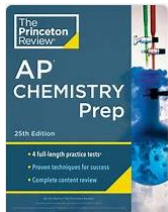
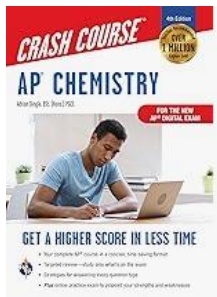


# AP Chemistry Summer Assignment

Steinbrenner High School 2025-2026

Roschell Thybulle

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<b>Purpose:</b>	The purpose of our assignment is to make sure you are prepared to jump right into AP Chemistry content. There will be little time for review of chemistry honors material. This assignment will ensure you are starting with all the basics in place!
<b>Materials:</b>	<ul style="list-style-type: none"><li>- <b>Print out of AP Chemistry "To Memorize" List.</b> See attached list. There are helpful hints given to you as well.</li><li>- <b>Index cards or Quizlet (online or app)—to help you with the memorize list.</b></li><li>- <b>Highlighters</b></li><li>- <b>Summer Assignment Due Wednesday, August 14<sup>th</sup></b></li></ul> <div></div> <ul style="list-style-type: none"><li>- <b>The Princeton Review, Cracking the AP Chemistry Exam, 2024 or 2025 Edition (College Test Preparation)</b> This resource will be used throughout the year; and, having your own copy gives you the ability to highlight and write in the book. This book can be found at local bookstores for little less than \$30. It can also be ordered online at Amazon.com for approximately \$25 or a used copy may be purchased for around \$23. Half.com or Thriftbooks.com may be another resource to find used copies of the text. In July or August the 2026 version is released. <b>Either version will work</b> perfectly as they are usually the same content with new page numbers.</li><li>- <b>AP Chemistry Crash Course Book, +Get a Higher Score in Less Time, fourth Edition (optional—but a good review)</b> This resource will be used throughout the year; and, having your own copy gives you the ability to highlight and write in the book. This book can be found at local bookstores for about \$15. It can also be ordered online at Amazon.com for approximately \$15. Half.com or Thriftbooks.com may be another resource to find used copies of the text. The third edition is available for about \$10 and is available digitally. <b>Either version will work</b> perfectly as they are usually the same content with new page numbers.</li></ul> <div></div>
<b>Methods:</b>	<ol style="list-style-type: none"><li>1. <b>Create flash cards or a Quizlet (online and/or app) to aid in memorizing:</b><ol style="list-style-type: none"><li>a. Elements (common)</li><li>b. Common ions &amp; their charges</li><li>c. Polyatomic ions (there are more than what you already learned in Hon Chem)</li><li>d. Diatomics –<b>Br I N Cl H O F</b></li><li>e. Metric Prefixes and conversion factors</li><li>f. Other Conversion Factors (Temperature, Energy, Moles etc)</li><li>g. Naming compounds (nomenclature)</li></ol></li><li>2. <b>Prepare using The Princeton Review Book</b><ol style="list-style-type: none"><li>a. <b>Write your name on your book!</b> Then, break it in! Flip the pages, take a look around, and see what's in there!</li><li>b. <b>Part I-</b> skim through how to use this book to improve your AP Score</li></ol></li></ol>

- c. **Part II: Practice Test**—Skim through—don't stress—just get an idea of the questions, content, and format of the exam
- d. **Part III**—Read through the reading about the AP Chemistry exam and highlight any important info to know about the exam
  - i. We will discuss first week of school too!
- e. **Part IV**—Skim through this chapter, it describes strategies to approach each question type. We will hit this harder throughout the school year, but it will give you an idea of what is expected on the AP exam.
- f. **Part V—Content Review (We will use this all year long)**
  - i. **There will be a test within the first two weeks of school on the “Basics” from the summer assignment (as well as the “to memorize” list).**
- g. **Summer Assignment**—Work out the problems that are on the assignment. Circle or highlight anything that you need more practice on and be sure to let me know at **open house** or the first two days of school. All concepts were taught in Chemistry Honors. This is more about review than accuracy. Do your best.

## Conclusion

Below is a summary of what will be due to hold you accountable for the AP Chemistry Summer Assignment.

- Bring your *Princeton Review* book with you the first week of school
- Chemistry Summer Assignment Due Wednesday, August 13th
- Discussion of AP Curriculum and Exam (first few days of school)
- Test on the Basics and the “To Memorize List” (within the first two weeks)
- Link to Reference Sheets [AP Chemistry Equations Sheet](#) [AP Chemistry Periodic Table of the Elements](#)

**Tuesday, May 5, 2026 at 8 am?? you will sit for the AP Chemistry Exam and pass! ☺**

*After working very hard all year long it will all be worthwhile when you calmly sit for the exam. Within a few moments of opening your test booklet you will realize you have studied and prepared to the absolute best of your ability—meaning you can conquer one of the hardest AP tests out there. Victory can be yours!*

I am looking forward to an exciting and productive year! I can be contacted via e-mail at [Roschell.Thybulle@hcps.net](mailto:Roschell.Thybulle@hcps.net) with questions, comments, or concerns.

## Enrichment

### Remind App:

Join our class Remind before school starts and feel free to ask questions!

There is a remind app for your phone/tablet or you can use it through the website.

- Text "@tybull2025" to the following number: 81010
- Or check out the following link: <https://www.remind.com/join/tybull2025>

### Zoom/Microsoft Teams Sessions:

In late July/early August I will host some Microsoft sessions. I will send the dates, times, links, passwords out through a Remind message. This is great chance for us to meet each other, go over some of the chemistry, and answer any questions.

At this time, I will also release the Summer Assignment Test Topic List so you may begin to prepare with more focus. Whether you are a year removed from chem 1, took it online and have questions, or just need a refresher to make sure you feel solid with the basics, this is a great chance for us to get ahead of the game!

**Community Class Supplies** I ask that each student contribute so we have plenty for everyone to use! Thank you! Choose one of the following or go to the Amazon wishlist: [https://www.amazon.com/hz/wishlist/ls/QZX5HOTLYFF5?ref=wl\\_share](https://www.amazon.com/hz/wishlist/ls/QZX5HOTLYFF5?ref=wl_share)

High demand	Roll of paper towels & one package of wipes
High demand	Box of tissues & one package of wipes

### Personal Class Supplies

Lots of paper and a graphing calculator

Of your choosing... pick a way to stay organized!

Idea 1: 2 Binders

- Bring to school a small binder for current materials and keep a larger binder at home to save older units to review.

Idea 2: Folders

- Buy a folder for each unit and as they are completed keep them at home to review.

Your main goal will be to learn the material and stay organized. I encourage you to do that however you think is best!

# AP CHEMISTRY To Memorize List

## a. Elements (common)

The Periodic Table (P.T) given on the AP exam does NOT have element names written out, only symbols are used. Therefore, you must be familiar with their names in order to use the periodic table effectively. Below is a list of common elements you are expected to know the name and symbol of (spelling counts).

H	He	Li	Be	B	C	N	O	F	Ne
Na	Mg	Al	Si	P	S	Cl	Ar	K	Ca
Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn
As	Se	Br	Kr	Rb	Sr	Y	Zr	Mo	Pd
Ag	Cd	Sn	Sb	Te	I	Xe	Cs	Ba	La
W	Pt	Au	Hg	Pb	Bi	Po	At	Rn	Fr
U	Pu								

## b. Common ions & 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 first day of class. You will always be allowed a periodic table, which makes identifying the ions on the left "automatic." For tips on learning these ions, keep reading! ☺

- Ions easily found on the P.T.**—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.
  - All Group 1 Elements (alkali metals) lose one electron to form an ion with a 1+ charge (Hydrogen can sometimes gain or lose...pesky hydrogen!)
  - All Group 2 Elements (alkaline earth metals) lose two electrons to form an ion with a 2+ charge
  - Group 13 metals like aluminum lose three electrons to form an ion with a 3+ charge
  - All Group 17 Elements (halogens) gain one electron to form an ion with a 1- charge
  - All Group 16 nonmetals gain two electrons to form an ion with a 2- charge
  - All Group 15 nonmetals gain three electrons to form an ion with a 3- charge
- These ions can be organized into two groups (cations and anions)
  - Notice that cations keep their name (sodium ion, calcium ion) while anions get an "-ide" ending (chloride ion, oxide ion).

<b>Ions easily found on the P.T.</b>			
<b>Cations</b>		<b>Anions</b>	
<b>Cations</b>	<b>Name</b>	<b>Anions</b>	<b>Name</b>
H <sup>+</sup>	Hydrogen	H <sup>-</sup>	Hydride
Li <sup>+</sup>	Lithium	F <sup>-</sup>	Fluoride
Na <sup>+</sup>	Sodium	Cl <sup>-</sup>	Chloride
K <sup>+</sup>	Potassium	Br <sup>-</sup>	Bromide
Rb <sup>+</sup>	Rubidium	I <sup>-</sup>	Iodide
Cs <sup>+</sup>	Cesium	O <sup>2-</sup>	Oxide
Be <sup>2+</sup>	Beryllium	S <sup>2-</sup>	Sulfide
Mg <sup>2+</sup>	Magnesium	Se <sup>2-</sup>	Selenide
Ca <sup>2+</sup>	Calcium	N <sup>3-</sup>	Nitride
Ba <sup>2+</sup>	Barium	P <sup>3-</sup>	Phosphide
Sr <sup>2+</sup>	Strontium	As <sup>3-</sup>	Arsenide
Al <sup>3+</sup>	Aluminum		

3. **Ions found on the P.T. but don't follow a pattern**—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 cation.

1. Note there are a few exceptions to these transition metals (silver and zinc) because in nature they only ever form those particular charges so no need to specify with a roman numeral.

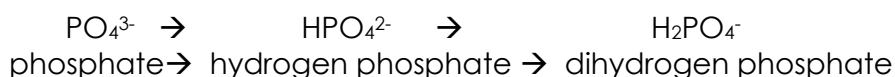
<b>Ions found on the P.T. but don't follow a pattern</b>			
<b>Cations</b>	<b>Name</b>	<b>Cations</b>	<b>Name</b>
Fe <sup>2+</sup>	Iron (II)	Sn <sup>2+</sup>	Tin (II)
Fe <sup>3+</sup>	Iron (III)	Sn <sup>4+</sup>	Tin (IV)
Cu <sup>+</sup>	Copper (I)	Pb <sup>2+</sup>	Lead (II)
Cu <sup>2+</sup>	Copper (II)	Pb <sup>4+</sup>	Lead (IV)
Co <sup>2+</sup>	Cobalt (II)	Hg <sub>2</sub> <sup>2+</sup>	Mercury (I)**dimeric
Co <sup>3+</sup>	Cobalt (III)	Hg <sup>2+</sup>	Mercury (II)
Ag <sup>+</sup>	Silver ***no roman number needed b/c only charge silver has	Zn <sup>2+</sup>	Zinc ***no roman number needed b/c only charge zinc has

### c. Polyatomic ions (see table on the next page)

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.
  - sulfate is SO<sub>4</sub><sup>2-</sup>, so sulfite has the same charge but one less oxygen (SO<sub>3</sub><sup>2-</sup>)
  - nitrate is NO<sub>3</sub><sup>-</sup>, so nitrite has the same charge but one less oxygen (NO<sub>2</sub><sup>-</sup>)
2. **If you add a hydrogen to the front, it changes the charge by +1.**
  1. If you know that a sulfate ion is SO<sub>4</sub><sup>2-</sup> 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... HSO<sub>4</sub><sup>-</sup>

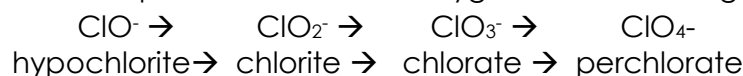
EXAMPLE:



### 3. Series with the prefixes hypo and hyper...

1. Learn the hypochlorite chlorite chlorate perchlorate series, and you also know the series containing iodite/iodate as well as bromite/bromate.
2. The relationship between the "ite" and "ate" ion is predictable, as always. Learn one and you know the other.
3. The prefix "hypo" means "under" or "too little" (think "hypodermic", "hypothermic" or "hypoglycemia")
  - Hypochlorite is "under" chlorite, meaning it has one less oxygen
4. The prefix "hyper" means "above" or "too much" (think "hyperkinetic")
  - the prefix "per" is derived from "hyper" so perchlorate (hyperchlorate) has one more oxygen than chlorate.

EXAMPLE: Notice how this sequence increases in oxygen while retaining the same charge:



Polyatomic Ions			
-1	Name	-2 or -3	Name
HSO <sub>4</sub> <sup>-</sup>	Hydrogen sulfate (bisulfate)	SO <sub>3</sub> <sup>2-</sup>	Sulfite
NO <sub>2</sub> <sup>-</sup>	Nitrite	SO <sub>4</sub> <sup>2-</sup>	Sulfate
NO <sub>3</sub> <sup>-</sup>	Nitrate	S <sub>2</sub> O <sub>3</sub> <sup>2-</sup>	Thiosulfate
OH <sup>-</sup>	Hydroxide	O <sub>2</sub> <sup>2-</sup>	Peroxide
CN <sup>-</sup>	Cyanide	C <sub>2</sub> O <sub>4</sub> <sup>2-</sup>	Oxalate
NCS <sup>-</sup>	Thiocyanate	AsO <sub>4</sub> <sup>3-</sup>	Arsenate
HCO <sub>3</sub> <sup>-</sup>	Hydrogen carbonate (bicarbonate)	CO <sub>3</sub> <sup>2-</sup>	Carbonate
ClO <sup>-</sup>	Hypochlorite	CrO <sub>4</sub> <sup>2-</sup>	Chromate
ClO <sub>2</sub> <sup>-</sup>	Chlorite	Cr <sub>2</sub> O <sub>7</sub> <sup>2-</sup>	Dichromate
ClO <sub>3</sub> <sup>-</sup>	Chlorate	SiO <sub>3</sub> <sup>2-</sup>	Silicate
ClO <sub>4</sub> <sup>-</sup>	Perchlorate		
BrO <sup>-</sup>	Hypobromite		
BrO <sub>2</sub> <sup>-</sup>	Bromite		
BrO <sub>3</sub> <sup>-</sup>	Bromate		
BrO <sub>4</sub> <sup>-</sup>	Perbromate		
IO <sup>-</sup>	Hypoiodite		
IO <sub>2</sub> <sup>-</sup>	Iodite		
IO <sub>3</sub> <sup>-</sup>	Iodate		
IO <sub>4</sub> <sup>-</sup>	Periodate		
H <sub>2</sub> PO <sub>4</sub> <sup>-</sup>	Dihydrogen phosphate	HPO <sub>4</sub> <sup>2-</sup>	Hydrogen phosphate
C <sub>2</sub> H <sub>3</sub> O <sub>2</sub> <sup>-</sup>	Acetate	PO <sub>4</sub> <sup>3-</sup>	Phosphate
MnO <sub>4</sub> <sup>-</sup>	Permanganate	PO <sub>3</sub> <sup>3-</sup>	Phosphite
N <sub>3</sub> <sup>-</sup>	Azide	BO <sub>3</sub> <sup>3-</sup>	Borate
NH <sub>2</sub> <sup>-1</sup>	Amide		
NH <sub>4</sub> <sup>+1</sup>	<b>Ammonium ***Only positive poly on this list!!</b>		

\*\*The different colored shading is attempting to show relationships between various polys. Grouping information helps you better retain this information for the long term. If left unshaded...sorry, no relationship on this list.

#### d. Diatomics

Diatomics are non-metal elements that when found alone must be covalently bonded to another atom of themselves to be stable. □ These 7 elements will always have a subscript of "2" when written by themselves.

Diatomic Elements	
H <sub>2</sub>	Hydrogen
N <sub>2</sub>	Nitrogen
F <sub>2</sub>	Fluorine
O <sub>2</sub>	Oxygen
I <sub>2</sub>	Iodine
Cl <sub>2</sub>	Chlorine
Br <sub>2</sub>	Bromine

#### How to Remember the Diatomic Elements

- Six of them make a "7" in the periodic table on the right hand side plus hydrogen to make the 7th element of the list

- The elements ending with "-gen" plus the halogens form diatomic molecules.

- An easy-to-remember mnemonic for the diatomic elements is:  
**Have No Fear Of Ice Cold Beer**

### e. Metric Prefixes and conversion factors

- Make sure you know the symbol for each and how to convert between any that are given to you.

Prefix	Symbol for Prefix		Scientific Notation
exa	E	1 000 000 000 000 000 000	$10^{18}$
peta	P	1 000 000 000 000 000	$10^{15}$
tera	T	1 000 000 000 000	$10^{12}$
giga	G	1 000 000 000	$10^9$
mega	M	1 000 000	$10^6$
kilo	k	1 000	$10^3$
hecto	h	100	$10^2$
deka	da	10	$10^1$
---	--	1	$10^0$
deci	d	0.1	$10^{-1}$
centi	c	0.01	$10^{-2}$
milli	m	0.001	$10^{-3}$
micro	$\mu$	0.000 001	$10^{-6}$
nano	n	0.000 000 001	$10^{-9}$
pico	p	0.000 000 000 001	$10^{-12}$
fermto	f	0.000 000 000 000 001	$10^{-15}$
atto	a	0.000 000 000 000 000 001	$10^{-18}$

### f. Other Conversion Factors (Temperature, Energy, Moles etc)

- Be familiar and able to work any of these simple conversions.

Other Conversion Factors	
Temperature	$K = C + 273$
	$^{\circ}F = ^{\circ}C \times 9/5 + 32$ (never used)
	$^{\circ}C = (^{\circ}F - 32) \times 5/9$ (never used)
Energy	1 cal = 4.184 J
	1 Cal = 1000 cal
Moles	1 mol = $6.02 \times 10^{23}$ particles
	1 mol = molar mass on PT ( in grams)
Gases	1 atm = 760 torr = 760 mm Hg = 101.3 kPa
	STP = 1 atm @ $0^{\circ}C$
	1 mol = 22.4L of gas @STP

### g. Naming compounds (nomenclature)

- Refer to [TX C.7AB ChemicalFormulas EXPLORE StudentReferenceSheet SummaryChartofNamingCompounds.ppt.pdf](#) or [julio-torres-nomenclature-inorganic.pdf](#)
- Should be **VERY** comfortable naming: Ionic compounds, Covalent Compounds, Polys, and Acids

## Summer Assignment 2024-2025

### A review of: Significant Figures, Dimensional Analysis (Converting), Atomic Theory, Periodic Table, Naming/Writing Chemical Formulas (including acids), calculating Average Atomic Mass, Balancing Equations, Mole Conversions, and Stoichiometry

- How many significant figures are there in each of the following values?
  - 0.002330
  - 13.00
  - 322.1221
  - 1204.30
  - 0.0002
  - 2200.0
  - 0.0331120
- Use exponential notation to express the number 22,100,000 with:
  - one significant figure
  - two significant figures
  - three significant figures
  - six significant figures
- Perform the indicated calculations on the following measured values, giving the final answer with the correct number of significant figures.
  - $16.81 + 3.2257$
  - $324.6 \times 815.991$
  - $2.85 + 3.4621 + 1.3$
  - $7.442 - 7.429$
  - $1.65 \times 14$
  - $27 / 4.148$
  - $[(3.901 - 3.887) / 3.901] \times 1.00$
  - $6.404 \times 2.91 \times (18.7 - 17.1)$
- A radio station broadcasts at a frequency of 107.9 megahertz. What is the broadcast frequency in gigahertz?
- Which of the following is greater:
  - 35 kg or 3500 g?
  - 60000 mL or 6000 L
- Perform the following temperature conversions:
  - 100 Celsius to Kelvin
  - 1555 Kelvin to Celsius
  - 45 Celsius to Kelvin
  - 920 Kelvin to Celsius
- A sample of motor oil with a mass of 440 g occupies 500 mL. What is the density of the motor oil?
- The density of an object is 16.3 g/mL. Its volume is 0.27 L. What is the mass of the object?
- The density of the earth is about 3.5 g/cm<sup>3</sup>. If the earth has a radius of 7000 miles, what is its mass? ( 1 in = 2.54 cm; 1 ft = 12 in; 5280 ft = 1 mi)
- Identify the following elements:
  - mass # 91 atomic # 40
  - mass # 108 atomic # 47
  - mass # 33 atomic # 16
  - mass # 85 atomic # 36
  - mass # 51 atomic # 23
  - mass # 133 atomic # 55
- How many protons and neutrons are in each of the following elements? Also, identify the elements.
  - mass # 89 atomic # 39
  - mass # 73 atomic # 32
  - mass # 24 atomic # 12 2+ charge
  - mass # 238 atomic # 92
  - mass # 35 atomic # 17 1- charge
  - mass # 65 atomic # 30

12. How many protons, neutrons and electrons are in each of the following ions?
- mass # 56 atomic # 26  $\text{Fe}^{3+}$
  - mass # 40 atomic # 20  $\text{Ca}^{2+}$
  - mass # 19 atomic # 9  $\text{F}^{1-}$
  - mass # 31 atomic # 15  $\text{P}^{3-}$
  - mass # 127 atomic # 53  $\text{I}^{1-}$
  - mass # 127 atomic # 53  $\text{I}^{7+}$
13. Name the family to which each of the following elements belong:
- Fe
  - Cl
  - Ar
  - Sr
  - Rb
  - Nd
14. Are the following elements metals or nonmetals?
- Mg
  - Si
  - Ge
  - Br
  - O
  - Bi
  - Co
  - Mo
  - Xe
15. Given the position in the periodic table, what is the most likely oxidation state that each element will have when forming an ion?
- Cs
  - N
  - Br
  - K
  - Al
  - S
16. Name each of the following compounds:
- $\text{PbI}_2$
  - $\text{NH}_4\text{Cl}$
  - $\text{Fe}_2\text{O}_3$
  - $\text{LiH}$
  - $\text{CsCl}$
  - $\text{OsO}_4$
  - $\text{Cr}(\text{OH})_3$
  - $\text{NaC}_2\text{H}_3\text{O}_2$
  - $\text{K}_2\text{Cr}_2\text{O}_7$
  - $\text{Na}_2\text{SO}_4$
  - $\text{KH}_2\text{PO}_4$
17. Name each of the following compounds:
- |                   |                              |                           |
|-------------------|------------------------------|---------------------------|
| a. $\text{NI}_3$  | c. $\text{CO}$               | e. $\text{N}_2\text{O}_4$ |
| b. $\text{PCl}_5$ | d. $\text{P}_4\text{O}_{10}$ | f. $\text{NH}_3$          |

18. Name each of the following compounds: (be careful some of these are acids)

- a.  $\text{HIO}_3$
- b.  $\text{HBr}$
- c.  $\text{HNO}_2$
- d.  $\text{HCN}$
- e.  $\text{NaNO}_2$
- f.  $\text{K}_2\text{SO}_3$
- g.  $\text{NaHSO}_3$

19. Write formulas for each of the following compounds:

- a. sodium cyanide
- b. Tin(II) fluoride
- c. sodium hydrogen sulfate
- d. lead(II) nitrate
- e. iron(III) oxide
- f. calcium phosphate
- g. sodium bromate
- h. hydrogen iodide

20. Write formulas for each of the following compounds:

- a. potassium carbonate
- b. magnesium hydroxide
- c. dinitrogen tetroxide
- d. hypoiodous acid
- e. iron(III) chloride
- f. tin(IV) oxide
- g. rubidium nitrate
- h. potassium chlorate
- i. carbon tetrachloride
- j. sodium iodate
- k. potassium permanganate
- l. sulfurous acid
- m. potassium hydrogen phosphate
- n. ammonium acetate
- o. ammonium dichromate
- p. hydroiodic acid

21. Give the names of the following acids:

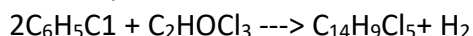
- a.  $\text{H}_2\text{SO}_3$
- b.  $\text{HI}$
- c.  $\text{HBr}$
- d.  $\text{HNO}_2$
- e.  $\text{H}_3\text{PO}_4$
- f.  $\text{HCl}$

22. Give formulas for the following acids:

- a. nitric acid
- b. hydrofluoric acid
- c. sulfuric acid
- d. hydrocyanic acid
- e. hydrosulfuric acid
- f. acetic acid

23. Give the names of seven diatomic elements.
24. Define the word isotope.
25. An element "E" is present as  $^{10}\text{E}$  with a mass value of 10.01 amu, and as  $^{11}\text{E}$  with a mass value of 11.01 amu. The natural abundances of  $^{10}\text{E}$  and  $^{11}\text{E}$  are 19.78% and 80.22% respectively. What is the average atomic mass of the element? What is the element?
26. Naturally occurring sulfur consists of four isotopes,  $^{32}\text{S}$  (95.0%),  $^{33}\text{S}$  (0.76%),  $^{34}\text{S}$  (4.22%), and  $^{36}\text{S}$  (0.014%). Using these data, calculate the atomic weight of naturally occurring sulfur. The masses of the isotopes are given in the table below.
- | Isotope         | Atomic mass (amu's) |
|-----------------|---------------------|
| $^{32}\text{S}$ | 31.97               |
| $^{33}\text{S}$ | 32.97               |
| $^{34}\text{S}$ | 33.97               |
| $^{36}\text{S}$ | 35.97               |
27. A sample of sulfur (S) has a mass of 5.37 g. How many moles are in the sample? How many atoms?
28. What is the mass of  $4.28 \times 10^{22}$  molecules of water ( $\text{H}_2\text{O}$ )?
29. Calculate the mass percent of Cl in each of the following compounds:
- $\text{ClF}$
  - $\text{HClO}_2$
  - $\text{CuCl}_2$
  - $\text{PuOCl}$
30. Which of the following formulas can be empirical?
- $\text{CH}_4$
  - $\text{CH}_2$
  - $\text{KMnO}_4$
  - $\text{N}_2\text{O}_5$
  - $\text{B}_2\text{H}_6$
  - $\text{Sb}_2\text{S}_3$
  - $\text{N}_2\text{O}_4$
  - $\text{CH}_2\text{O}$
  - $\text{NH}_4\text{Cl}$
31. Fill in the blanks to balance the following chemical equations:
- $\_\_\_\text{AgI} + \_\_\_\text{Na}_2\text{S} \rightarrow \_\_\_\text{Ag}_2\text{S} + \_\_\_\text{NaI}$
  - $\_\_\_\text{(NH}_4\text{)}_2\text{Cr}_2\text{O}_7 \rightarrow \_\_\_\text{Cr}_2\text{O}_3 + \_\_\_\text{N}_2 + \_\_\_\text{H}_2\text{O}$
  - $\_\_\_\text{Na}_3\text{PO}_4 + \_\_\_\text{HCl} \rightarrow \_\_\_\text{NaCl} + \_\_\_\text{H}_3\text{PO}_4$
  - $\_\_\_\text{TiCl}_4 + \_\_\_\text{H}_2\text{O} \rightarrow \_\_\_\text{TiO}_2 + \_\_\_\text{HCl}$
  - $\_\_\_\text{Ba}_3\text{N}_2 + \_\_\_\text{H}_2\text{O} \rightarrow \_\_\_\text{Ba(OH)}_2 + \_\_\_\text{NH}_3$
  - $\_\_\_\text{HNO}_2 \rightarrow \_\_\_\text{HNO}_3 + \_\_\_\text{NO} + \_\_\_\text{H}_2\text{O}$
32. How many grams of water vapor can be generated from the combustion of 18.74 g of ethanol?
- $$\_\_\_\text{C}_2\text{H}_6\text{O(g)} + \_\_\_\text{O}_2\text{(g)} \rightarrow \_\_\_\text{CO}_2\text{(g)} + \_\_\_\text{H}_2\text{O(g)} \text{ (unbalanced)}$$
33. The reaction between potassium chlorate and red phosphorus is highly exothermic and takes place when you strike a match on a matchbox. If you were to react 52.9 g of potassium chlorate ( $\text{KClO}_3$ ) with red phosphorus, how many grams of tetraphosphorus decoxide ( $\text{P}_4\text{O}_{10}$ ) would be produced?
- $$\_\_\_\text{KClO}_3\text{(s)} + \_\_\_\text{P}_4\text{(s)} \rightarrow \_\_\_\text{P}_4\text{O}_{10}\text{(s)} + \_\_\_\text{KCl(s)} \text{ (unbalanced)}$$
34. A reaction proceeds between 94.6 g of  $\text{KClO}_3$  and 65.3 g of  $\text{P}_4$  (see problem #33).
- How much potassium chloride is formed?
  - Which reactant is limiting? Which is in excess?
  - How much of the excess reactant is left over?
  - If the actual yield of potassium chloride were 21.0 g, what was the percent yield?

35. DDT, an insecticide harmful to fish birds and humans, is produced by the following reaction:



chlorobenzene chloral DDT

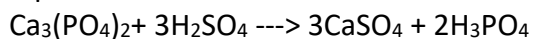
In a government lab 1142 g of chlorobenzene were reacted with 485 g of chloral.

- How much DDT is formed?
  - Which reactant is limiting? Which is in excess?
  - How much of the excess reactant is left over?
  - If the actual yield of DDT is 2000 g, what was the percent yield?
36. A substance contains 23.0 g sodium, 27.0 g aluminum, and 114 g fluorine. How many grams of sodium are there in a 120.-g sample of the substance?
37. An oxide of iron contains 69.9% iron. What percent by mass of oxygen does this compound contain?
38. How many moles of oxygen are necessary to burn 2.0 moles of benzene,  $\text{C}_6\text{H}_6$  to carbon dioxide and water? Be sure to write a balanced equation.

39. The reaction of 11.9 g of  $\text{CHCl}_3$  with excess chlorine produced 12.6 g of  $\text{CCl}_4$ , carbon tetrachloride:  $2\text{CHCl}_3 + 2\text{Cl}_2 \rightarrow 2\text{CCl}_4 + 2\text{HCl}$

What is the percent yield?

40. Phosphoric acid can be prepared by reaction of sulfuric acid with "phosphate rock" according to the equation:



Suppose the reaction is carried out starting with 103 g of  $\text{Ca}_3(\text{PO}_4)_2$  and 75.0 g of  $\text{H}_2\text{SO}_4$ . Which substance is the limiting reactant?