

AP CHEMISTRY SUMMER ASSIGNMENT

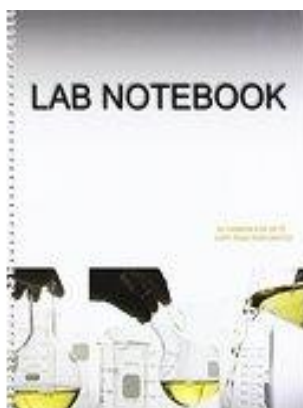
Over the summer, you will be responsible for completing a summer assignment packet. The assignment will be posted, **beginning June 15, 2019**, on the Clements website under my name, C Ericson – AP Chemistry – AP Chemistry Resources. These assignments cover material previously taught in Chemistry I. It is meant as a review and recommended you complete the assignment a few weeks before the start of the school year. It is not necessary to purchase an AP Chemistry book to complete these assignments.

Bring completed summer assignment packet with you on the first day of school – Wed August 14, 2019. A quiz over the “*Common and Polyatomic Ions to be Memorized*” list will be on Thurs. August 15, 2019. You must know everything on that list – including the common names! A test over all the summer assignments will be on

Tues. August 20, 2019.

- ❖ To access the summer assignments: Go to www.fortbendisd.com, click on *Schools* and select *Clements*. On the CHS website, you should see a summer assignment section – locate the AP Chemistry Summer Assignment 2019 **or** you can click on *Teacher Websites*, then select my name – *Ericson, Carolyn*. Once on my webpage, select *AP Chemistry – AP Chemistry Resources* and select *Summer Assignment 2019*. The list of ions to be memorized, as well as the summer assignment are listed. Print the summer assignment packet and complete.
- ❖ Also, we will be using a Carbonless Laboratory Notebook (75 pages minimum) for our after school labs. You may either purchase one online (for example Amazon) or you can send me an email over the summer and at the end of August I can place an order through the bookstore manager at UH – Sugar Land. The cost typically is between \$15-17.

Example of Carbonless Lab Notebook (you do not have to this specific one – just make sure it has a minimum of 75 pages and is carbonless)



Common & Polyatomic Ions to be Memorized

<u>Name</u>	<u>Symbol</u>	<u>Name</u>	<u>Symbol</u>	<u>Common Name</u>
Aluminum ion	Al^{3+}	Acetate ion	$\text{C}_2\text{H}_3\text{O}_2^-$ or CH_3COO^-	
Ammonium ion	NH_4^+	Oxalate ion	$\text{C}_2\text{O}_4^{2-}$	
Antimony (III) ion	Sb^{3+}	Carbide ion	C^{4-}	
Antimony (V) ion	Sb^{5+}	Cyanide ion	CN^-	
Barium ion	Ba^{2+}	Carbonate ion	CO_3^{2-}	
Beryllium ion	Be^{2+}	Hydrogen carbonate ion	HCO_3^-	Bicarbonate ion
Bismuth ion	Bi^{3+}	Borate ion	BO_3^{3-}	
Cadmium ion	Cd^{2+}	Bromate ion	BrO_3^-	
Calcium ion	Ca^{2+}	Hypobromite ion	BrO^-	
Chromium (II) ion	Cr^{2+}	Bromide ion	Br^-	
Chromium (III) ion	Cr^{3+}	Perchlorate ion	ClO_4^-	
Copper (I) ion	Cu^+	Chlorate ion	ClO_3^-	
Copper (II) ion	Cu^{2+}	Chlorite ion	ClO_2^-	
Hydronium ion	H_3O^+	Hypochlorite ion	ClO^-	
Iron (II) ion	Fe^{2+}	Chloride ion	Cl^-	
Iron (III) ion	Fe^{3+}	Chromate ion	CrO_4^{2-}	
Lead (II) ion	Pb^{2+}	Dichromate ion	$\text{Cr}_2\text{O}_7^{2-}$	
Lead (IV) ion	Pb^{4+}	Fluoride ion	F^-	
Lithium ion	Li^+	Hydride ion	H^-	
Magnesium ion	Mg^{2+}	Hydroxide ion	OH^-	
Manganese (II) ion	Mn^{2+}	Oxide ion	O^{2-}	
Manganese (IV) ion	Mn^{4+}	Peroxide ion	O_2^{2-}	
Mercury (I) ion	Hg_2^{2+}	Iodate ion	IO_3^-	
Mercury (II) ion	Hg^{2+}	Hypoiodite ion	IO^-	
Nickel ion	Ni^{2+}	Iodide ion	I^-	
Potassium ion	K^+	Nitrate ion	NO_3^-	
Silver ion	Ag^+	Nitrite ion	NO_2^-	
Sodium ion	Na^+	Nitride ion	N^{3-}	
Strontium ion	Sr^{2+}	Permanganate ion	MnO_4^-	
Tin (II) ion	Sn^{2+}	Phosphate ion	PO_4^{3-}	
Tin (IV) ion	Sn^{4+}	Hydrogen phosphate ion	HPO_4^{2-}	
Zinc ion	Zn^{2+}	Dihydrogen phosphate ion	H_2PO_4^-	
		Phosphite ion	PO_3^{3-}	
		Phosphide ion	P^{3-}	
		Sulfate ion	SO_4^{2-}	
		Hydrogen sulfate ion	HSO_4^-	Bisulfate ion
		Sulfite ion	SO_3^{2-}	
		Sulfide ion	S^{2-}	
		Thiocyanate ion	SCN^-	
		Thiosulfate ion	$\text{S}_2\text{O}_3^{2-}$	

AP CHEMISTRY SUMMER ASSIGNMENT – 2019

CHEMICAL FOUNDATIONS

Significant Figures and Unit Conversions

- 1) How many significant figures are in each of the following?
a) 100 b) 1.00×10^2 c) 100.
d) 0.0048 e) 0.00480 f) 2303.03
- 2) Round off each of the following numbers to the indicated number of significant figures, and write the number in standard scientific notation.
a) 0.00034159 to three sig figs b) 103.351 to four sig figs
c) 17.9915 to 5 sig figs d) 3.365×10^5 three sig figs
- 3) Use exponential notation to express the number 385,500 to
a) 1 sig fig b) 2 sig figs c) 3 sig figs d) 4 sig figs
- 4) Perform the following mathematical operations, and express the result to the correct number of significant figures.
a) $2.526/3.1 + 0.470/0.632 + 80.705/0.4326$
b) $(6.404 \times 2.91) / (18.7 - 17.1)$
c) $\frac{(8.925 - 8.905)}{8.925} \times 100$ (percent error calculation, assume 100 is an exact number)

For #5-8, must show all work using dimensional analysis! Express answers with correct units and significant figures.

- 5) A parsec is an astronomical unit of distance where 1 parsec = 3.26 light years. (1 light year equals the distance traveled by light in one year). If the speed of light is 3.0×10^8 m/s, calculate the distance in meters of an object that travels 9.6 parsecs.
- 6) You pass a road sign saying "New York 112 km". If you drive at a constant speed of 65 mi/h, how long should it take for you to reach New York? If your car gets 28 miles to the gallon, how many liters of gasoline are necessary to travel 112 km? (1 mile = 1.6901 km, 3.785 L = 1 gallon)
- 7) Mercury poisoning is a debilitating disease that is often fatal. In the human body, mercury reacts with essential enzymes leading to irreversible inactivity of these enzymes. If the amount of mercury in a polluted lake is 0.4 micrograms Hg per mL, what is the total mass in kilograms of mercury in the lake? (The lake has a surface area of 100 mi² and an average depth of 20 ft.)
- 8) Lipitor, a pharmaceutical drug that has been shown to lower "bad" cholesterol levels while raising "good" cholesterol levels in patients taking the drug, had over 11 billion dollars in sales in 2006. Assuming one 2.5 g pill contains 4.0 % of the active ingredient by mass, what mass in kg of active ingredient is present in one bottle of 100 pills?

Density

9) A rectangular block has dimensions 2.9 cm x 3.5 cm x 10.0 cm, the mass of the block is 615.0 g. What are the volume and density of the block? (Show all work, express answer with correct sig figs and unit)

Classification/Separation of Matter

10) Classify each of the following as a mixture or a pure substance:

- | | | | |
|----------|------------|---------------|---------------|
| a) water | b) blood | c) the oceans | d) iron |
| e) brass | f) uranium | g) wine | h) table salt |

Of the pure substances, which are elements and which are compounds?

11) Classify the following as physical or chemical changes:

- Moth balls gradually vaporize in the closet
- Hydrofluoric acid attack glass and is used to etch calibration marks on glass laboratory utensils.
- Chemistry majors sometimes get holes in the cotton jeans they wear because of acid spills.
- A cup of tea becomes sweeter as sugar is added to it.

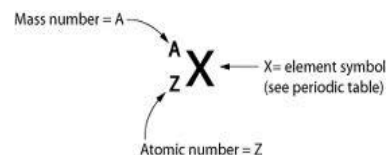
ATOMS, IONS, AND MOLECULES**Dalton's Atomic Theory**

Law of definite proportions: A given compound always contains the same proportion of elements by mass.

12) A sample of chloroform is found to contain 12.0 g of carbon, 106.4 g of chlorine, and 1.01 g of hydrogen. If a second sample of chloroform is found to contain 30.0 g of carbon, what is the total mass of chloroform in the second sample?

14) Write the atomic symbol for each of the following isotopes:

- $Z = 8$, number of neutrons = 9
- the isotope of chlorine in which $A = 37$
- the isotope of I with a mass number of 131
- Complete the following table:



Symbol	Number of Protons In Nucleus	Number of Neutrons In Nucleus	Number of Electrons	Net Charge
$^{238}_{92}\text{U}$				
	20	20		2^+
	23	28	20	
$^{89}_{39}\text{Y}$				
	35	44	36	
	15	16		2^-

Nomenclature

15) Name the following compounds:

- | | |
|----------------------------|--------------------------------------|
| a) MgSO_4 | b) Fe_2O_3 |
| c) N_2O_3 | d) NH_3 |
| e) KMnO_4 | f) $\text{Cr}(\text{OH})_3$ |
| g) ZnCO_3 | h) AgNO_3 |
| i) $\text{HCN}(\text{aq})$ | j) $\text{HBr}(\text{aq})$ |
| k) NaHCO_3 | l) $\text{HIO}_3(\text{aq})$ |
| m) P_4O_6 | n) BF_3 |
| o) LiH | p) $\text{K}_2\text{Cr}_2\text{O}_7$ |

16) Write formulas for the following compounds

- | | |
|----------------------------|--------------------------------|
| a) sulfur trioxide | b) lead (II) nitrate |
| c) potassium chlorate | d) ammonium phosphate |
| e) hydrosulfuric acid | f) diphosphorus pentoxide |
| g) iron (III) chloride | h) nickel chloride hexahydrate |
| i) acetic acid | j) iron (II) chlorite |
| k) sodium hydrogen sulfate | l) carbonic acid |
| m) uranium hexafluoride | n) ammonium oxalate |
| o) barium chloride | p) potassium bicarbonate |

17) Name the following alkanes (remember the general formula $\text{C}_n\text{H}_{2n+2}$):

- | | |
|------------------------------|------------------------------|
| a) CH_4 | b) C_2H_6 |
| c) C_4H_{10} | d) C_7H_{16} |

Write the correct formulas for the following alkanes:

- | | |
|------------|-----------|
| e) octane | f) ethane |
| g) propane | h) decane |

18) Name the following alcohols ($\text{C}_n\text{H}_{2n+1}\text{OH}$)

- | | |
|---------------------------|---------------------------------------|
| a) CH_3OH | b) $\text{C}_5\text{H}_{11}\text{OH}$ |
|---------------------------|---------------------------------------|

Write the correct formula for the following alcohols:

- | | |
|------------|------------|
| c) ethanol | d) hexanol |
|------------|------------|

Must show all work for all problems in this stoichiometry section. Express answers with correct units and significant figures.

Average Atomic Mass

- 19) A noble gas consists of three isotopes of masses of 19.99 amu, 20.99 amu, and 21.99 amu. The relative abundances of these isotopes are 90.92%, 0.257%, and 8.82% respectively. What is the average atomic mass of this noble gas? What noble gas is this?
- 20) The element Europium exists in nature as 2 isotopes: ^{151}Eu has a mass of 150.9196 amu, and ^{153}Eu has a mass of 152.9209 amu. The average atomic mass of Europium is 151.96 amu. Calculate the relative abundances of the two Europium isotopes.

Moles and Molar Masses

- 21) A diamond contains 5.0×10^{21} atoms of carbon. What amount (moles) of carbon and what mass (grams) of carbon are in this diamond?
- 22) What amount (moles) is represented by each of these samples?
- a) 150.0 g of iron (III) oxide

 - b) 10.0 mg of nitrogen dioxide

 - c) 2.7×10^{23} molecules of ethanol
- 23) a) Calculate the molar mass of sodium hydrogen phosphate
- b) What mass of sodium hydrogen phosphate is present in 5.00 moles of the compound?

 - c) What number of formula units is present in 1.00 g of sodium hydrogen phosphate?

 - d) What number of oxygen atoms is present in 1.00 g of sodium hydrogen phosphate?

- 24) Dimethylnitrosamine, $(\text{CH}_3)_2\text{N}_2\text{O}$, is a carcinogenic (cancer causing) substance that may be formed in foods, beverages, or gastric juices from the reaction of nitrite ion (used as a food preservative) with other substances.
- What is the molar mass of dimethylnitrosamine?
 - How many moles of dimethylnitrosamine molecules are present in 250 mg dimethylnitrosamine?
 - What is the mass of 0.050 mole of dimethylnitrosamine?
 - How many atoms of hydrogen are in 1.0 mole of dimethylnitrosamine?
 - What is the mass of 1.0×10^6 molecules of dimethylnitrosamine?
 - What is the mass in grams of one molecule of dimethylnitrosamine?

Percent Composition

- 25) Calculate the mass percent of each element in potassium dihydrogen phosphate.

Empirical and Molecular Formulas

- 26) Vanillin is often used in the production of vanilla extract, Vanillin contains the following percentages by mass:

$$\text{C} = 63.18 \%, \text{H} = 5.26 \%, \text{O} = 31.56\%$$

Determine the empirical formula of vanillin.

- 27) A compound is found, by mass spectral analysis, to contain the following percentages of elements by mass:

$$\text{C} = 49.97 \%, \text{Cl} = 48.92\%, \text{H} = 1.39 \%$$

The molar mass of the compound is 289.9 g/mole. Determine the empirical and molecular formulas of the compound.

Writing and Balancing Chemical Equations

28) Balance the following equations, then classify each reaction as either synthesis, decomposition, single replacement, double replacement, or combustion:

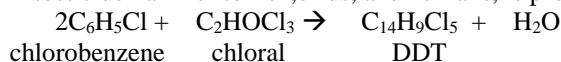
- (a) $\text{N}_2(\text{g}) + \text{H}_2(\text{g}) \rightarrow \text{NH}_3(\text{g})$
 (b) $\text{Li}(\text{s}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{LiOH}(\text{aq}) + \text{H}_2(\text{g})$
 (c) $\text{KClO}_3(\text{s}) \rightarrow \text{KCl}(\text{s}) + \text{O}_2(\text{g})$
 (d) $\text{C}_6\text{H}_{14}(\text{g}) + \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{g})$
 (e) $\text{H}_2\text{SO}_4(\text{aq}) + \text{NaOH}(\text{aq}) \rightarrow \text{Na}_2\text{SO}_4(\text{aq}) + \text{H}_2\text{O}(\text{l})$

29) Complete and balance the following reactions, also classify each reaction

- (a) calcium (s) + nitrogen (g) \rightarrow
 (b) octane (g) + oxygen (g) \rightarrow
 (c) bromine (l) + potassium iodide (aq) \rightarrow
 (d) copper (II) chloride (aq) + sodium sulfide (aq) \rightarrow
 (e) sodium chlorate (s) \rightarrow
 (f) barium oxide (s) + water (l) \rightarrow
 (g) magnesium carbonate (s) \rightarrow
 (h) zinc (s) + hydrochloric acid (aq) \rightarrow

Reaction Stoichiometry (Again, make sure you show all work and express answers with correct sig. figs and units)

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



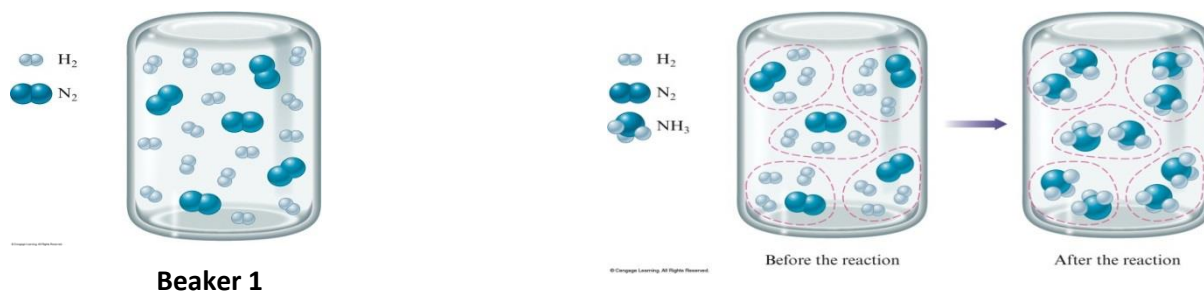
In a government lab, 1142 g of chlorobenzene is reacted with 485 g of chloral.

- a) Which reactant is limiting? Which is excess?
 b) What mass of DDT is formed, assuming 100% yield?
 c) What mass of the excess reactant is left over?
 d) If the actual yield of DDT is 200.0 g. what is the percent yield?

31) Consider the unbalanced reaction: $\text{P}_4(\text{s}) + \text{F}_2(\text{g}) \rightarrow \text{PF}_3(\text{g})$

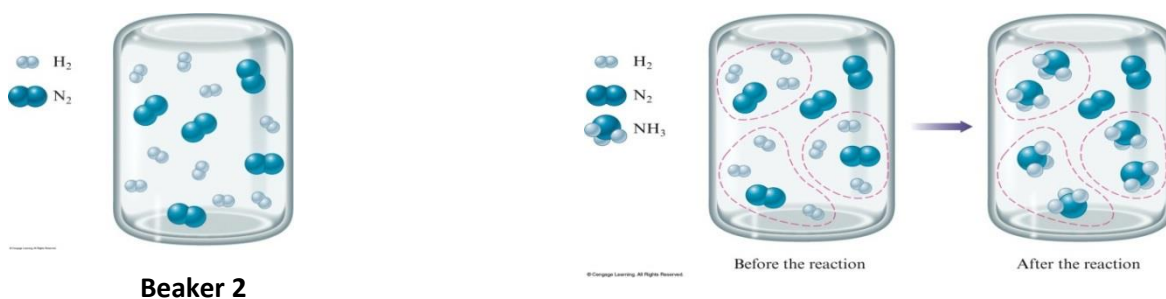
What mass of fluorine gas is needed to produce 120. g of PF_3 if the reaction has a 78.1 % yield?

1. (a) Write the balanced equation representing the reaction between nitrogen gas and hydrogen gas to form ammonia gas:



(b) Ratio of Hydrogen to Nitrogen according to balanced equation:

(c) Ratio of Hydrogen to Nitrogen in the Beaker 1:



2. Ratio of Hydrogen to Nitrogen in the Beaker 2:

Limiting reactant?

Excess reactant?

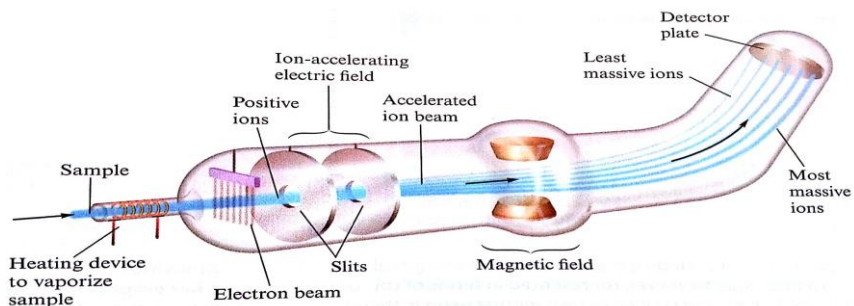
3. Nitrogen monoxide gas reacts with oxygen gas to product nitrogen dioxide gas.



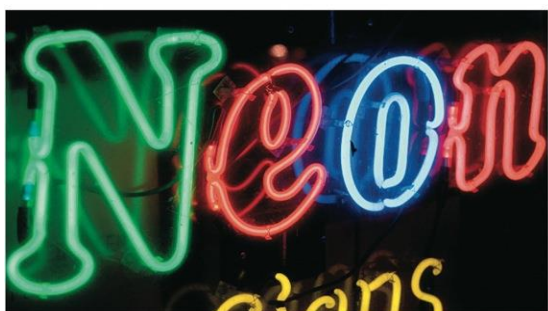
What is the balanced equation for this reaction, and what is the limiting reactant?

Complete the particle diagram on the right showing particles present after the reaction is complete.

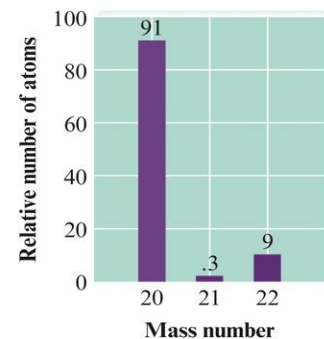
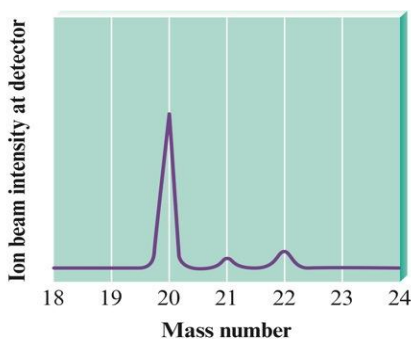
The most accurate method currently available for comparing the masses of atoms involves the use of the **mass spectrometer**. In this instrument diagrammed below, atoms or molecules are passed into a beam of high-speed electrons, which knock electrons off the atoms or molecules being analyzed and change them into positive ions. An applied electric field then accelerates these ions into a magnetic field. Because an accelerating ion produces its own magnetic field, an interaction with the applied magnetic field occurs, which tends to change the path of the ion. The amount of path deflection for each ion depends on its mass – the most massive ions are deflected the smallest amount – which causes the ion to separate, as show in the figure below. A comparison of the positions where the ions hit the deflector plate gives very accurate values of their relative masses.



Example #1:



David Young-Wolff/Alamy



Based on mass spectrometer data given in (b) and (c) above, identify the isotopes of neon and approximate relative percentages of each isotope.

Example #2: Calculate the approximate average atomic mass of the element below. Identify the element

