AP Chemistry Summer Assignment

Welcome to AP Chemistry! There are TWO parts to your summer assignment. Part 1 deals with the memorization of common ions used in this course. Part 2 reviews notes and practice problems from unit 1 which is a review of sophomore chemistry. Please also join our AP classroom- the summer assignments links will be there in case you misplace them.
The link is: **p35aq4k**

PART 1: COMMON IONS
For this part of the summer assignment you need to master the formulas, charges, and names of the common ions. On the first day of the school year, you will be given a quiz on these ions and also formula writing. 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
-write chemical formulas from these ions
<u>*the only polyatomics you will need to memorize are those we commonly use: ammonium, nitrite, nitrate, sulfite, sulfate, hydroxide, phosphate, carbonate, chlorate, perchlorate, acetate and permanganate. You will not be quizzed on the others*</u>

I have included several resources in this packet. First, there is a table of the ions that you must know on the first day. I have also included some suggestions for making the process of memorization easier. For instance, many of you will remember that most of the monatomic ions have charges that are directly related to their *placement on the periodic table*. There are naming patterns that greatly simplify the learning of the polyatomic ions as well.

Also included is a copy of the periodic table used in AP Chemistry. This <u>*is not*</u> the table used in first year chemistry. The AP table is the same that the College Board allows you to use on the AP Chemistry test. Notice that it has the symbols of the elements but <u>*not*</u> the written names. You need to take that fact into consideration when studying for the quiz!

PART 2: Review of sophomore chemistry
The first few units in AP chemistry are a review of your first year chemistry class (with a few things added). Please read through the notes packet for topic 1.1 and 1.3 and answer the questions at the end- we will go over the answers on the first day of school. There are some additional questions over sig figs, stoichiometry, naming compounds, etc.- this is also a review of sophomore chemistry and will be due on the first day of school (it will be your first daily grade).

I look forward to seeing you all at the beginning of the next school year. If you need to contact me or have questions my email is <u>lylesmk@lisdeagles.net</u>.

Common Polyatomic Ions

Ion	Name	Ion	Name
NH_4^+	Ammonium	CO_3^{2-}	Carbonate
NO_2^-	Nitrite	HCO_3^-	Hydrogen carbonate Or Bicarbonate
NO_3^-	Nitrate	ClO^-	Hypochlorite
SO_3^{2-}	Sulfite	ClO_2^-	Chlorite
SO_4^{2-}	Sulfate	ClO_3^-	Chlorate
HSO_4^-	Hydrogen sulfate Or Bisulfate	ClO_4^-	Perchlorate
OH^-	Hydroxide	$C_2H_3O_2^-$	Acetate
CN^-	Cyanide	MnO_4^-	Permanganate
PO_4^{3-}	Phosphate	$Cr_2O_7^{2-}$	Dichromate
HPO_4^{2-}	Hydrogen phosphate	CrO_4^{2-}	Chromate
$H_2PO_4^{2-}$	Dihydrogen phosphate	O_2^{2-}	Peroxide

1A 1	2A 2	3B 3	4B 4	5B 5	6B 6	7B 7	8B 8	8B 9	8B 10	1B 11	2B 12	3A 13	4A 14	5A 15	6A 16	7A 17	8A 18
Li^+													C^{4-}	N^{3-}	O^{2-}	F^-	
Na^+	Mg^{2+}											Al^{3+}		P^{3-}	S^{2-}	Cl^-	
K^+	Ca^{2+}				Cr^{2+} Cr^{3+}	Mn^{2+} Mn^{3+}	Fe^{2+} Fe^{3+}	Co^{2+} Co^{3+}	Ni^{2+} Ni^{3+}	Cu^+ Cu^{2+}	Zn^{2+}				Se^{2-}	Br^-	
Rb^+	Sr^{2+}									Ag^+	Cd^{2+}		Sn^{2+} Sn^{4+}		Te^{2-}	I^-	
Cs^+	Ba^{2+}										Hg_2^{2+} Hg^{2+}		Pb^{2+} Pb^{4+}				

Common monatomic ions arranged by their positions in the periodic table. Note that mercury(I), Hg_2^{2+}, is not actually a monatomic ion.

What common d–block ion (see the figure above) is isoelectronic with Zn^{2+}?

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 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 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:
   (phosphate) PO_4^{3-} → (hydrogen phosphate) HPO_4^{2-} → (dihydrogen phosphate) $H_2PO_4^{1-}$

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:

$$ClO^- \rightarrow ClO_2^- \rightarrow ClO_3^-$$

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** (263)	107 **Bh** (262)	108 **Hs** (265)	109 **Mt** (266)	110 **§** (269)	111 **§** (272)	112 **§** (277)						

§Not yet named

*Lanthanide Series	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
†Actinide Series	90 **Th** 232.04	91 **Pa** 231.04	92 **U** 238.03	93 **Np** 237.05	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** (260)

Chemical Reaction Rules for AP Chemistry

Be familiar (don't memorize) with rules…Net ionics are more important!

Synthesis Rules

A metal oxide plus carbon dioxide yields a metal carbonate.
A metal oxide plus water yields a metal hydroxide.
A nonmetal oxide plus water yields an oxyacid.
A metal chloride plus oxygen yields a metal chlorate.

Decomposition Rules

Metal carbonates break down to yield metal oxides and carbon dioxide.
Metal chlorates break down to yield metal chlorides and oxygen.
Hydrogen peroxide decomposes into water and oxygen.
Oxyacids break down to yield water and nonmetal oxides.
Metal hydroxides break down to yield water and metal oxides.

Single Replacement Process

Single Replacement is a reaction where one element displaces another in a compound.
One element is oxidized and another is reduced.

General formula: $A + BC \rightarrow B + AC$

Active metals replace less active metals or hydrogen from their compounds.
Active halogens replace less active halogens from their compounds in aqueous solution.

Double Replacement Process

Two compounds react to form two new compounds. No changes in oxidation numbers occur. All double replacement reactions must have a "driving force" that removes a pair of ions from solution.

Driving Forces:

1. *Precipitation*: A precipitate is an insoluble substance formed by the reaction of two aqueous substances. Two ions bond together so strongly that water can not pull them apart.
2. *Formation of a Gas:* Gases may form directly in a double replacement reaction, such as H_2S, or can form from the decomposition of a product such as H_2CO_3 (into CO_2 and H_2O) or H_2SO_3 (into SO_2 and H_2O) or NH_4OH (into NH_3 and H_2O).
3. *Formation of a molecular/covalent substance:* When a molecular substance such as water or acetic acid is formed, ions are removed from solution.

Combustion Process

Hydrocarbons or alcohols combine with oxygen to form carbon dioxide and water.

Elements or compounds combine with oxygen to form an oxide compound.

How to Write a Net Ionic – LEARN THIS (see below if this is new to you)!

1. Write a balanced equation – include states of matter.
2. Split *aqueous ionic* or *strong acids* into ions. Keep it balanced and include charges!
3. Cancel out any *ions* that appear split and identical on both sides.

Example 2:	$Fe_{(s)} + AgNO_{3(aq)} \rightarrow$?
Molecular Equation:	$Fe_{(s)} + 2\ AgNO_{3(aq)} \rightarrow 2\ Ag_{(s)} + Fe(NO_3)_{2(aq)}$
Ionic Equation:	$Fe_{(s)} + 2\ Ag^{+}_{(aq)} + 2\ NO_3^{-}{}_{(aq)} \rightarrow 2\ Ag_{(s)} + Fe^{2+}_{(aq)} + 2\ NO_3^{-}{}_{(aq)}$
Net Ionic Equation:	$Fe_{(s)} + 2\ Ag^{+}_{(aq)} \rightarrow 2\ Ag_{(s)} + Fe^{2+}_{(aq)}$
The driving force was the transfer of electrons from iron (the reducing agent) to the silver ion (the oxidizing agent).	

TOPIC: 1.1 MOLES AND MOLAR MASS

ENDURING UNDERSTANDING:

SPQ-1	The mole allows different units to be compared

LEARNING OBJECTIVE:

SPQ-1.A	Calculate quantities of a substance or its relative number of particles using dimensional analysis and the mole concept.

ESSENTIAL KNOWLEDGE:

SPQ-1.A.1	One cannot count particles directly while performing laboratory work. Thus, there must be a connection between the masses of substances reacting and the actual number of particles undergoing chemical changes.
SPQ-1.A.2	Avogadro's number ($N_A = 6.022 \times 10^{23}$ particles/mole) provides the connection between the number of moles in a pure sample of a substance and the number of constituent particles (or formula units) of that substance.
SPQ-1.A.3	Expressing the mass of an individual atom or molecule in atomic mass units (amu) is useful because the average mass in amu of one particle (atom or molecule) or formula unit of a substance will always be numerically equal to the molar mass of that substance in grams. Thus, there is a quantitative connection between the mass of a substance and the number of particles that the substance contains.

EQUATION(S):

$n = m/M$

moles = mass/molar mass

NOTES:

It is impractical to count atoms as they are so small, so in chemistry we can "count" atoms by weighing them or measuring them in some other way. We need to convert the measurements that we make into numbers of atoms so that we can be sure to react the right amounts of materials. Atomic masses are measured in atomic mass units, amu, which is a relative unit, based on the carbon-12 isotope being assigned a mass of exactly 12 grams per mole. A mole is a term used to describe a group of atoms containing 6.022×10^{23} items. Chemists use moles to discuss amounts of atoms because using the actual amount of atoms is such a large number it is often impractical. You can calculate the mass for one mole of a substance by referring to the periodic table to find the average atomic mass of each atom then adding up the total mass for the formula.

14.0067	15.9994
N	O
7	8
Nitrogen	Oxygen

How to calculate <u>Molar Mass</u>:

1) List the atoms
2) Count the atoms
3) Find the mass of each atom from the periodic table
4) Multiply the number of atoms (#2) by the mass of each atom (#3)
5) Add together the values (#4)

Calculate the molar mass of dinitrogen tetroxide:

N_2O_4

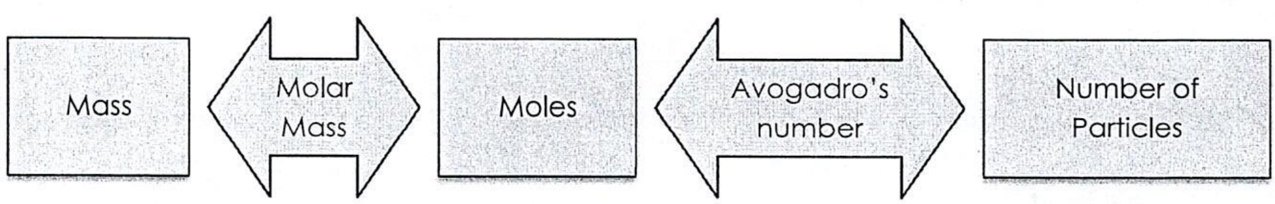
N = 2 x 14.0067 = 28.0134

O = 4 x 15.9994 = <u>63.9976</u>

92.0110 g/mole

Molar mass can be used as a conversion factor to convert between moles and grams. It is unique for each sample.

Avogadro's Number, 6.022×10^{23} particles/mole, is the conversion factor to convert between number of particles (molecules, atoms, formula units, ions) and moles.



I DO:

How many moles of Lead (II) iodide, PbI_2, are there in a 25.0 gram sample?

$$25.0 \text{ g } PbI_2 \times \frac{1 \text{ mole}}{461.0 \text{ g}} = 0.0542 \text{ mole } PbI_2$$

How many atoms of lead, Pb, are in the sample?

$$0.0542 \text{ moles } PbI_2 \times \frac{1 \text{ mol Pb}}{1 \text{ mole } PbI_2} \times \frac{6.022 \times 10^{23} \text{ atoms Pb}}{1 \text{ mole Pb}} = 3.27 \times 10^{22} \text{ atoms Pb}$$

WE DO:

A 0.244 g sample of calcium carbonate, $CaCO_3$, was recovered from a sample of hard water. How many formula units of $CaCO_3$ were in the sample?

ionic compound

$$\frac{0.244 \text{ g } CaCO_3}{1} \times \frac{1 \text{ mol } CaCO_3}{100.0869 \text{ g } CaCO_3} \times \frac{6.02 \times 10^{23} \text{ f.u.}}{1 \text{ mol } CaCO_3} = \boxed{1.47 \times 10^{21} \text{ f.u. } CaCO_3}$$

SCAN ME

YOU DO:

1) Methane, CH_4, is the gas commonly found in labs to fuel Bunsen burners.
   a) How many moles of methane are there in a 7.21 gram sample?
   b) How many particles of methane are there in the sample?
   c) How many atoms of hydrogen are found in the sample?

2) Helium, He, is used in balloons, deep sea diving tanks, and in industry. While it is the second most abundant element in the universe, in 2019 there was a shortage of helium which caused the prices to rise. If 150. grams of helium is needed to cool a superconductor, how many atoms of helium are used?

3) If you know the mass and identity of a sample, what other information do you need in order to find the number of each atom in the sample?

4) Given 10.0 gram samples of LiCl, LiBr, LiF and LiI, place the samples in order of least to greatest number of atoms of Lithium, Li.

5) What is the mass of one atom of carbon-12?

6) What is the mass of 2.30×10^{24} particles of water, H_2O?

7) Which is a greater mass, 0.25 moles of carbon dioxide, CO_2, or 1.5×10^{23} particles of carbon monoxide, CO?

Topic: 1.3 Elemental Composition of Pure Substances

Enduring Understanding:	
SPQ-2	Chemical Formulas identify substances by their unique combination of atoms
Learning Objective:	
SPQ-2.A	Explain the quantitative relationship between the elemental composition by mass and the empirical formula of a pure substance
Essential Knowledge:	
SPQ-2.A.1	Some pure substances are composed of individual molecules, while others consist of atoms or ions held together in fixed proportions as described by a formula unit.
SPQ-2.A.2	According to the law of definite proportions, the ratio of the masses of the constituent elements in any pure sample of that compound is always the same.
SPQ-2.A.3	The chemical formula that lists the lowest whole number ratio of atoms of the elements in a compound is the empirical formula.
Equation(s):	
	N/A

Notes:

A pure substance is one with constant composition; a pure substance can either be an element or a compound

When dealing with compounds you can assume it follows the law of definite proportion, which states compounds with the same elements in the same proportion are the SAME compound.

Following the law of definite proportion, you can find the percent composition which is the percent by mass of each element that makes up a compound.
To calculate the percent composition, you divide the mass of each element in a compound by the total molar mass of the substance.

In compounds, the **empirical formula** represents the simplest ratio of one element to another in a compound. The **molecular formula** represents the actual formula for the substance.

An example is glucose which has the molecular formula $C_6H_{12}O_6$ but the empirical formula is CH_2O.

To determine the empirical and molecular formula.

% to mass
mass to moles
divide by least
multiply til whole

1. Determine the *empirical formula* for the compound when given percent of each element
   a. Assume you are given a 100g sample so you can change percent to grams
   b. For each element take grams / molar mass to get moles of each element
   c. Divide each mole value by the lowest of the values
   d. If you are within 0.1 of a whole number round to the whole number, if you are not you must multiply by a factor that gives you whole numbers for all.
   e. The values you found are the subscripts for each element
2. Determine *molecular formula* (can only determine if given molar mass of substance)
   a. Find mass of empirical formula
   b. Molar mass/ empirical formula mass to find factor
   c. Multiply all subscripts in the empirical formula by the value

I DO:

A certain sugar used in treating patients with low blood sugar has the following chemical composition: 40.0 % carbon, 6.70 % hydrogen, and 53.3 percent oxygen. What is the empirical formula?

40.0 % C → 40.0 g C (1 mol/12.011 g C) = 3.33 moles C / 3.33 moles = 1

6.70% H → 6.70 g H (1 mol/1.01 g H) = 6.63 moles H / 3.33 moles = 2

53.3 % O → 53.3 g O (1 mol/16.0 g O) = 3.33 moles O /3.33 moles = 1

CH_2O

The molar mass of the compound is 180 grams/mole. What is the molecular formula of this compound?

C = 1 x 12.01 = 12.01

H = 2 x 1.01 = 2.02

O = 1 x 16.00 = 16.00

30.03 g/mole

(30.03 g/mol) *x = 180 g/mol

x = 6 $C_6H_{12}O_6$

WE DO:

a. A compound is found to contain 56.5% carbon, 7.11% hydrogen, and 36.4% phosphorus. Find the empirical formula.

$\frac{56.5\,g\,C}{1} \times \frac{1\,mol\,C}{12.01\,g\,C} = \frac{4.70\,mol\,C}{1.17} \rightarrow 4.01\,mol\,C$ $\boxed{C_4H_6P}$

$\frac{36.4\,g\,P}{1} \times \frac{1\,mol\,P}{30.97\,g\,P} = \frac{1.17\,mol\,P}{1.17} \rightarrow 1\,mol\,P$

$\frac{7.11\,g\,H}{1} \times \frac{1\,mol\,H}{1.008\,g\,H} = \frac{7.05\,mol\,H}{1.17} \rightarrow 6.02\,mol\,H$

empirical mass 85.058

b. If the compound has a molar mass of 170.14 g/mol, what is its molecular formula?

$\frac{\text{molar mass} \rightarrow 170.14}{\text{(reduced) empirical} \rightarrow 85.058} = 2$ $\boxed{C_8H_{12}P_2}$

YOU DO:

1. The most abundant molecule found in the human body is 88.810% oxygen and 11.190% hydrogen. Calculate the empirical formula for this substance.

2. Arginine is one of the amino acids; it is used in the biosynthesis of proteins. Analysis revealed that a sample of arginine was 41.368 % carbon, 8.101% hydrogen, 32.162 % nitrogen and 18.369% oxygen.
   a. What is the empirical formula of arginine?
   b. The molecular weight of arginine is 174.204 grams/mole. What is the molecular formula?

3. The empirical and molecular formulas of urea are the same. 90 % of the world's urea is used for fertilizer. If the percentage composition of the elements in urea are 19.999% carbon, 6.713% hydrogen, 46.646% nitrogen and 26.641% oxygen.

4. A compound containing phosphorus and oxygen is a powerful desiccant. The compound is 43.642% phosphorus and 56.358% oxygen.

a. Calculate the empirical formula for this compound.

b. The molar mass of this compound is 283.889044 g/mol, determine the molecular formula.

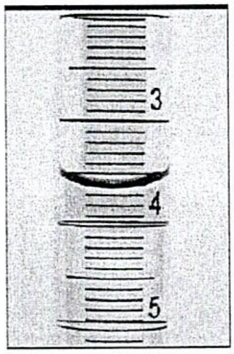
5. Emeralds are composed of 4 different elements in a fixed proportion. They are composed of 5.030 % beryllium, 10.040 % Aluminum, 31.351% Silicon and 53.579% oxygen. The empirical and molecular formula are the same.
   a. Calculate the empirical formula.

   b. Calculate the molar mass.

6. Iron can form three different oxides, FeO, Fe_2O_3 and Fe_3O_4. A sample of iron oxide was analyzed and was found to contain 69.943% iron with the rest of the mass from oxygen. Determine the empirical formula to determine the identity of the iron oxide.

7. Serotonin is a chemical that nerve cells produce from an essential amino acid called tryptophan. Tryptophan must enter our body through a balanced diet, and is commonly found in nuts, cheese and red meat. Serotonin is considered to be a natural mood stabilizer as it helps with sleeping, eating and digestion. A sample of serotonin was found to be 6.864% hydrogen, 68.159% carbon, 15.897% nitrogen and 9.079% oxygen. Calculate the empirical formula for serotonin.

Summary Assignment (due 1st day of school) **Name:** ______________
AP Chemistry 2023-2024



Significant Figures:

1. How many significant figures are in the following numbers?

   a. 0.0450 ________

   b. 790 ________

   c. 32.10 ________

   d. How many milliliters of water are in the burette (use correct sig figs)? ________

Prefixes:

2. What prefix do the following multiplication factors correspond to?

   a. 10^{-6} ________

   b. 10^{-3} ________

   c. 10^{3} ________

   d. 10^{6} ________

Conversions:

3. Make the following conversions (round answers correctly and show work with units):

   a. 16.2 m to km

   b. 5.44 nL to mL

   c. 45.7 ml/s to kL/hr

   d. 15 years to seconds (use 365.25 days per year)

   e. How many cm^2 are in an area of 4.21 in^2?

   f. 400 cm^3 to m^3

   g. 25°C to K

Density:

4. A liquid has a density of 1.48 g/cm^3. What volume of liquid has a mass of 5.00 grams?

5. The density of aluminum is 2.70 g/cm^3. If a cube of aluminum weighs 13.5 grams, what is the length of the edge of the cube?

6. In an experiment, you measure the density of aluminum as 2.60 g/cm^3. The accepted value is 2.70 g/cm^3. What is the percent error in your measurement?

Scientific Notation:

7. The mass of a paperclip is about 0.525 grams. What is the mass of this paperclip in kg? (report your answer in scientific notation).

8. The number, three hundred fifty thousand, written in scientific notation is best written as:

Moles:

9. Calculate the number of moles of the following (show work):
   a. 42.9 g of KNO_3

   b. 1557.7 L of CO_2 at STP

   c. 9.25×10^{26} formula units of $CaCl_2$

   d. How many individual carbon atoms are in 6.56 grams of $HC_2H_3O_2$?

Stoichiometry:

10. Using the following equation:

$$2NaOH + H_2SO_4 \rightarrow 2H_2O + Na_2SO_4$$

How many grams of sodium sulfate will be formed from 200 grams of sodium hydroxide and an excess of sulfuric acid?

11. Using the following equation:

$$Pb(SO_4)_2 + 4LiNO_3 \rightarrow Pb(NO_3)_4 + 2Li_2SO_4$$

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

12. Using the following equation:

$$Fe_2O_3 + 3H_2 \rightarrow 2Fe + 3H_2O$$

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

Limiting Reactant and Percent Yield:

13. 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: $2Na + Cl_2 \rightarrow 2NaCl$

14. Determine the mass of excess reactant left over when 50.0 g of lithium is reacted with 45.0 g of water according to the equation: $2Li + 2H_2O \rightarrow 2LiOH + H_2$

15. Determine the percent yield of water produced when 68.3 g of hydrogen reacts with 85.4 g of oxygen and 86.4 g of water are collected. $2H_2 + O_2 \rightarrow 2H_2O$

Percent Composition:

16. Calculate the percent composition of $C_{12}H_{22}O_{11}$ (sucrose). (Give percent of each element.)

<u>**Empirical and molecular formulas**</u> (percent to mass-mass to mole-divide by least-multiply til whole)

17. Determine the empirical formulas for a compound with the following percent composition:

15.8% carbon and 84.2% sulfur.

18. Determine the empirical and molecular formula for chrysotile asbestos. Chrysotile has the following percent composition: 28.03% Mg, 21.60% Si, 1.16% H, and 49.21% O. The molar mass for chrysotile is 520.8 g/mol.

Naming Compounds

19. Provide the names for the following ionic compounds/acids:
    a. $Fe(OH)_2$ ______________________
    b. $HClO_4$ ______________________
    c. $Ba(ClO_4)_2$ ______________________
    d. Hg_2S ______________________
    e. $Cr_2(CO_3)_3$ ______________________

20. Write the chemical formulas for the following compounds:
    f. Copper (I) oxide ______________________
    g. Potassium peroxide ______________________
    h. Iron (III) carbonate ______________________
    i. hydrocyanic acid ______________________
    j. Sodium hypobromite ______________________

21. Give the name of chemical formula for each of the following molecular substances:
    k. SF_6 ______________________
    l. XeO_3 ______________________
    m. IF_5 ______________________
    n. Dihydrogen monoxide ______________________
    o. Tetraphosphorus hexasulfide ______________________

22. Give the name or chemical formula for the following compounds:
    p. Ammonium oxalate ______________________
    q. Manganese (III) dichromate ______________________
    r. $Ti(OH)_4$ ______________________
    s. $Ni(ClO_2)_3$ ______________________
    t. Fe_2S_3 ______________________

Net ionic equations Write the net ionic equations for the following reactions. Make sure they are balanced first! Include states of matter in the equation. (6 strong acids are HCl, HBr, HI, HNO_3, $HClO_4$, H_2SO_4)

23. $Mg(NO_3)_2(aq) + Na_2CO_3(aq) \rightarrow MgCO_3(s) + NaNO_3(aq)$

24. $Ca(NO_3)_2\ (aq) + H_3PO_4\ (aq) \rightarrow HNO_3\ (aq) + Ca_3(PO_4)_2\ (s)$ *Remember that strong acids dissociate into ions but weak acids do not*