

## AP CHEMISTRY SUMMER ASSIGNMENT 2020-2021

Future AP Chemistry Student,

Welcome to AP Chemistry! In order to ensure the best start for everyone next fall, I have prepared a summer assignment. The assignment reviews some of the basic chemistry concepts that you should know upon arrival to class.

For those students who have already taken a high school chemistry course, the material in the summer packet should be familiar to you and should provide for a review of the basics. For those students who will be taking AP Chemistry as your first high school chemistry course, *you need to work to understand the topics in this packet.* Simply completing the assignment should not be the objective but one should be confident in their understanding of the material in the assignment.

It is important for everyone to arrive to the first day of class prepared. While the first week will be used to review, extensive remediation is not an option as we work towards our goal of being 100% prepared for the AP Exam in early May 2021.

You may contact me by email: ([tania\\_m\\_murphy@dekalbschoolsga.org](mailto:tania_m_murphy@dekalbschoolsga.org)) this summer. I will do my best to answer your questions ASAP.

Chemistry takes time to process and grasp at a level necessary for success in AP Chemistry. Remember, AP Chemistry is an equivalent course to Introductory Chemistry in college. Taking a college level course in high school is difficult, requires dedication, and is a great investment in your education so prepare yourself and arrive ready to learn.

Have a great summer!

Sincerely,

Ms. Murphy

AP CHEMISTRY Summer Assignment:

- I. Be familiar with numbers in scientific notation significant figures, using significant figures in calculations, density (the density of water is 1.00 g/mL unless told otherwise), and units of measurement

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)  $15.68 \text{ g}$  \_\_\_\_\_  
 $2.885 \text{ mL}$  \_\_\_\_\_

**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  $\text{g}/\text{cm}^3$ ? Will ruthenium metal float on water?

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

\*\*\* the density problems above are there for you to make sure you are reporting your answers to the correct number of sig figs AND rounding them correctly

**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

Temperature:

Temperature is a measure of the average \_\_\_\_\_ of a substance.

Temperature is measured in Kelvins (K), degrees Celsius ( $^{\circ}\text{C}$ ) or Fahrenheit (F)

Temperature conversions

$$\text{K} = ^{\circ}\text{C} + 273$$

$$\text{F} = ^{\circ}\text{C} \times 1.8 + 32$$

$$^{\circ}\text{C} = \text{F} - 32 / 1.8$$

II. Be familiar with the classifications of matter:

a. Solids vs liquids vs gases

- i. Solids -
- ii. Liquids -
- iii. Gases -

b. Atoms vs ions

- i. Atoms- composed of \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_ where the number of \_\_\_\_\_ is equal to the number of \_\_\_\_\_ and thus are electrically \_\_\_\_\_

ii. Ions- composed of \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_ where the number of \_\_\_\_\_ is not equal to the number of \_\_\_\_\_ and thus are electrically \_\_\_\_\_

1. Positive ions are called \_\_\_\_\_ and are formed when an element (or group of elements) \_\_\_\_\_ one or more electrons

2. Negative ions are called \_\_\_\_\_ and are formed when an element (or group of elements) \_\_\_\_\_ one or more electrons

c. Elements vs compounds

i. Elements – composed of only one type of \_\_\_\_\_

ii. Compounds – composed of more than one type of \_\_\_\_\_ that are \_\_\_\_\_ combined. If two compounds are identical then they will have the same percent composition if they are not identical then they will not have the same percent composition.

1. What is the percent composition of H<sub>2</sub>O?

d. Mixtures vs compounds

i. Mixtures are not chemically combined but rather are physically combined and therefore can physically be separated by using the distinct physical properties of each of the components of the mixture. Mixtures have various compositions (they are not definite as in compounds)

1. Separating a mixture based on differences in particle size:

\_\_\_\_\_

2. Separating a mixture based on differences in polarity:

\_\_\_\_\_

3. Separating a mixture based on differences in boiling points:

---

ii. Mixtures can be homogeneous (solutions) or heterogeneous (unevenly mixed)

iii. Compounds are formed when two or more different elements are held together by a chemical bond. They have a definite composition and cannot be physically separated.

1. Ionic compounds vs covalent compounds

a. Compounds formed between metals and nonmetals contain \_\_\_\_\_ bonds.

b. Compounds formed between nonmetals and nonmetals contain \_\_\_\_\_ bonds

2. Metallic compounds are simply metals and have a "sea of electrons"

3. The percent composition of a compound = mass of element in compound / mass of compound x 100

a. What is the percent composition of sucrose:  $C_6H_{12}O_6$ ?

III. Be familiar with the classifications of elements and their state at room temperature:

a. All metals are solid except for mercury which is a liquid.

i. Properties of metals:

b. All metalloids are solids.

i. Properties of metalloids:

c. Nonmetals: carbon, phosphorus, sulfur, & selenium are solids; bromine is a liquid; and the rest are gases.

i. Properties of nonmetals:

IV. Know the seven diatomic molecules:

a. The 7 diatomic molecules are: \_\_\_\_\_

b. Some other elements that also have subscripts are P<sub>4</sub> and S<sub>8</sub>

V. Be familiar with basic atomic structure:

a. Atomic number = \_\_\_\_\_

b. Mass number = \_\_\_\_\_ + \_\_\_\_\_

c. The charge of an atom/ion is determined by comparing the number of \_\_\_\_\_ to the number of \_\_\_\_\_

d. The nucleus contains the \_\_\_\_\_ and the \_\_\_\_\_ and the overall charge of the nucleus is \_\_\_\_\_.

e. The \_\_\_\_\_ are located in subshells on energy levels around the nucleus.

f. The valence electrons are \_\_\_\_\_

Symbol	Atomic number	Mass number	# of protons	# of electrons	# of neutrons	Net charge
$^{90}\text{Sr}^{+2}$			38			
$\text{Na}^{\cdot\cdot}$	11			10	12	
$\text{Br}^{\cdot\cdot\cdot}$	35	82				1-

VI. Be familiar with isotopes

- a. Isotopes are the same type of element with different numbers of \_\_\_\_\_ and therefore a different atomic mass.
  
- b. The average atomic mass (the mass on the periodic table) accounts for the mass and abundance of all isotopes of a given element:
  - i. Magnesium consists of 3 naturally occurring isotopes with the masses 23.98504 amu, 24.98584 amu, and 25.98254 amu. The relative abundances of these three isotopes are 78.70%, 10.13 %, and 11.17 %. Calculate the average atomic mass.

VII. Be familiar with the layout of the periodic table and the names of the first two and last two groups

- a. Periods: \_\_\_\_\_
  
- b. Groups: \_\_\_\_\_
  
- c. Name of group 1 elements: \_\_\_\_\_
  
- d. Name of group 2 elements: \_\_\_\_\_

e. Name of group 7A or 17B elements: \_\_\_\_\_

f. Name of group 8A or 18B elements: \_\_\_\_\_

g. Elements in the same group have the same number of \_\_\_\_\_ electrons.

h. Elements on the same period have valence electrons on the \_\_\_\_\_ energy level.

VIII. Be familiar with periodic trends:

a. First Ionization Energy:

i. Across a period : \_\_\_\_\_

ii. Down a group: \_\_\_\_\_

b. Electronegativity

i. Across a period : \_\_\_\_\_

ii. Down a group: \_\_\_\_\_

c. Atomic Radius

i. Across a period : \_\_\_\_\_

ii. Down a group: \_\_\_\_\_

IX. Be familiar with ions, both monatomic and polyatomic ions, chemical nomenclature and writing chemical equations

Write formulas for the following ions:

Chloride ion: \_\_\_\_\_ iron III ion: \_\_\_\_\_

Chlorate ion: \_\_\_\_\_ calcium ion: \_\_\_\_\_

Chlorite ion: \_\_\_\_\_ Copper I ion \_\_\_\_\_

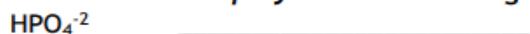


**Task 4: Memorize the names, symbols, and charges of Polyatomic ions below:**

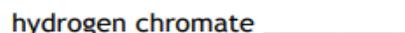
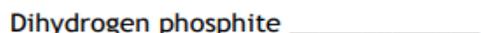
- Oxyanions - polyatomics containing oxygen, names end in *-ate* or *-ite*
- *-ate* is used for the most common form
- *-ite* is used for the form with the same charge, but one less oxygen
  - Example:
    - $\text{NO}_3^-$  = nitrate
    - $\text{NO}_2^-$  = nitrite
- Prefixes are also used
  - *Per-* indicates one more oxygen than the *-ate* form (think “perfect = overachieving” ie = more)
  - *Hypo-* indicates one fewer oxygen than the *-ite* form
  - Example:
    - $\text{ClO}_4^-$  = perchlorate (b/c it has one more O than the *-ate* form)
    - $\text{ClO}_3^-$  = chlorate (b/c it is the most common)
    - $\text{ClO}_2^-$  = chlorite (b/c it has one less oxygen than *-ate* form)
    - $\text{ClO}_4^-$  = hypochlorite (b/c it has one less oxygen than the *-ite* form)
  - F, Cl, Br, I all behave the same
    - Therefore, if chlorate is  $\text{ClO}_3^-$ , the bromate ion is...
    - $\text{BrO}_3^-$ !!!!
    - Simply substitute one halogen for the other
    - If you learn the chlorate series, you also automatically know the bromate, iodate, and fluorate series
- Hydrogen can be added to *-2* or *-3* ions to make a “new ion” i.e.  $\text{H}_2\text{PO}_4^-$  is dihydrogen phosphate (note the *-* charge went up 1 for each  $\text{H}^+$  added)

<u>+1</u> ammonium, $\text{NH}_4^+$		
<u>-1</u> acetate, $\text{C}_2\text{H}_3\text{O}_2^-$ , or $\text{CH}_3\text{COO}^-$ bromate, $\text{BrO}_3^-$ chlorate, $\text{ClO}_3^-$ chlorite, $\text{ClO}_2^-$ cyanide, $\text{CN}^-$ hydrogen carbonate, $\text{HCO}_3^-$ (also called bicarbonate) hydroxide, $\text{OH}^-$ hypochlorite, $\text{ClO}^-$ iodate, $\text{IO}_3^-$ nitrate, $\text{NO}_3^-$ nitrite, $\text{NO}_2^-$ permanganate, $\text{MnO}_4^-$ perchlorate, $\text{ClO}_4^-$ thiocyanate, $\text{SCN}^-$	<u>-2</u> carbonate, $\text{CO}_3^{2-}$ chromate, $\text{CrO}_4^{2-}$ dichromate, $\text{Cr}_2\text{O}_7^{2-}$ oxalate, $\text{C}_2\text{O}_4^{2-}$ peroxide, $\text{O}_2^{2-}$ sulfate, $\text{SO}_4^{2-}$ sulfite, $\text{SO}_3^{2-}$	<u>-3</u> phosphate, $\text{PO}_4^{3-}$ phosphite, $\text{PO}_3^{3-}$ arsenate, $\text{AsO}_4^{3-}$

**Be able to name polyatomic ions using the rules above such as these below:**



**Be able to write formulas for polyatomic ions using the rules above such as these below:**



VIII. Be familiar with chemical nomenclature:

**Worksheet #2: Practice Naming Compounds**

1. Provide names for the following ionic compounds:

- a.  $\text{AlF}_3$  \_\_\_\_\_
- b.  $\text{Fe}(\text{OH})_2$  \_\_\_\_\_
- c.  $\text{Cu}(\text{NO}_3)_2$  \_\_\_\_\_
- d.  $\text{Ba}(\text{ClO}_4)_2$  \_\_\_\_\_
- e.  $\text{Li}_3\text{PO}_4$  \_\_\_\_\_
- f.  $\text{Hg}_2\text{S}$  \_\_\_\_\_
- g.  $\text{Cr}_2(\text{CO}_3)_3$  \_\_\_\_\_
- h.  $(\text{NH}_4)_2\text{SO}_4$  \_\_\_\_\_

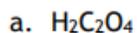
2. Write the chemical formulas for the following compounds:

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

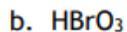
3. Give the name or chemical formula for each of the following molecular substances:

- a.  $\text{SF}_6$  \_\_\_\_\_
- b.  $\text{XeO}_3$  \_\_\_\_\_
- c. Dinitrogen tetroxide \_\_\_\_\_
- d. Hydrogen cyanide \_\_\_\_\_
- e.  $\text{IF}_5$  \_\_\_\_\_
- f. Dihydrogen monoxide \_\_\_\_\_

5. Name the following acids



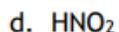
\_\_\_\_\_



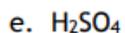
\_\_\_\_\_



\_\_\_\_\_



\_\_\_\_\_



\_\_\_\_\_



\_\_\_\_\_

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

\_\_\_\_\_

X. Be familiar with writing balanced chemical equations:

Write a balanced equation for the following:

a. Reaction of boron trifluoride gas with water to give liquid hydrogen fluoride and solid boric acid

b. Reaction of magnesium oxide with Iron to form iron (III) oxide and magnesium.

c. The decomposition of dinitrogen monoxide gas to its elements.

d. The reaction of calcium carbide solid with water to form calcium hydroxide and acetylene ( $\text{C}_2\text{H}_2$ ) gas.

e. Ethane ( $\text{C}_2\text{H}_6$ ) burns in air.

f. Carbon dioxide combines with water to form carbonic acid.

g. Magnesium and nitrogen gas combine to form magnesium nitride.

- h. Hydrochloric acid neutralizes sodium hydroxide to form sodium chloride and water.

XI. Be familiar with moles, molar conversions, empirical and molecular formulas, hydrates and stoichiometry ALWAYS SHOW YOUR WORK, ROUND YOUR ANSWER APPROPRIATELY AND TO THE CORRECT NUMBER OF SIG FIGS AND LABEL WITH THE CORRECT UNIT

#### MOLAR CONVERSIONS

1. Answer the following questions about a 50.0 g sample of sucrose  $C_6H_{12}O_6$ : (use T charts to show your work)
  - i. Number of moles of sucrose:
  
  
  
  
  
  
  
  
  
  
  - ii. Number of molecules of sucrose:
  
  
  
  
  
  
  
  
  
  
  - iii. Number of moles of hydrogen in the sample:
  
  
  
  
  
  
  
  
  
  
  - iv. Number of atoms of carbon in the sample
  
2. Answer the following questions about a sample of sodium phosphate ( $Na_3PO_4$ ) (use T charts to show your work)
  - i. The sample contains 13.5 g of sodium. What is the mass of the sample?
  
  
  
  
  
  
  
  
  
  
  - ii. How many phosphate ions are in 35.0 g of the sample? K
  
  
  
  
  
  
  
  
  
  
  - iii. How many atoms of oxygen are in 350.0 g of the sample?

3. The hormone, thyroxine is secreted by the thyroid gland, and has the formula:  $C_{15}H_{17}NO_4I_4$ . How many milligrams of Iodine can be extracted from 15.0 g of thyroxine?

#### EMPIRICAL AND MOLECULAR FORMULAS

1) What is the empirical formula that contains 0.783 g C, 0.196 g H and 0.5621 g of O?

2) What is the molecular formula of a compound that contains 1.388 g C, 0.345 g H, 1.850 g O and has a molecular mass of 124 g.

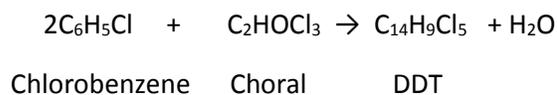
#### HYDRATES:

**A sample of copper (II) sulfate hydrate has a mass of 3.97 g. After heating, the  $CuSO_4$  that remains has a mass of 2.54 g. Determine the correct formula and name of the hydrate.**

**When 5.00 g of  $FeCl_3 \cdot xH_2O$  are heated, 2.00 g of  $H_2O$  are driven off. Find the chemical formula and the name of the hydrate.**

#### STOICHIOMETRY

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



If 1142 g of chlorobenzene is reacted with 485 g of chloral.

- Which reactant is limiting? Which is in excess? Justify with a calculation
- What mass of DDT is formed?
- What mass of excess reactant is left over?
- If the actual yield of DDT is 200.0 g, what is the percent yield?

XII. Be familiar with some gas law basics:

The term STP means: standard \_\_\_\_\_ and \_\_\_\_\_ -

For gases standard temperature is \_\_\_\_\_ and standard pressure is \_\_\_\_\_

At STP 1 mol of any gas has a volume of \_\_\_\_\_

The ideal gas law is: \_\_\_\_\_ and the value for "R" is dependent upon the unit for \_\_\_\_\_. The volume must be in \_\_\_\_\_ when using this equation.

GOOD JOB!!!! ALL OF THIS WILL BE APPLIED REAL SOON; SOME OF IT WILL BE REVIEWED IN CLASS AND SOME WILL BE "UNDERSTOOD" to be known. See you soon!!!!