YOUR NAME: _____

I WORKED WITH: _____

AP CHEMISTRY SUMMER WORK PACKAGE

This is due no later than *Monday, August 5, 2019*. It should be handed into the main Upper School office OR scanned and emailed to Ms. Van Liew. You are welcome to work with other students on this packet but everyone must hand in his/her own packet

Please show ALL work!! Problems will be graded on a right or wrong basis. You SHOULD NOT use the internet or other resources to find the answers to these questions. You <u>may</u> use the internet or other resources to get necessary information. If you are in doubt, please get in touch with me.

1. When water boils, there are bubbles that rise to the surface of the water. Is this a physical or chemical change? What is inside these bubbles? EXPLAIN your answer clearly!

2. *Underline* the significant figures in each of the following numbers:
   a. 100
   b. 1.0×10^2
   c. 100.

   d. 1.00×10^3
   e. 0.0048
   f. 0.00480

   g. 4.80×10^{-3}
   h. 4.800×10^{-4}
   i. 935,000

3. Evaluate each of the following and write the answer to the appropriate number of *significant figures with correct units*.
   a. $212.2 \text{ cm} + 26.7 \text{ cm} + 402.09 \text{ cm}$

   b. $1.0028 \text{ g} + 0.221 \text{ g} + 0.10337 \text{ g}$

   c. $52.331 \text{ mL} + 26.01 \text{ mL} - 0.9981 \text{ mL}$

   d. $(2.01 \times 10^2 \text{ m}) + (3.014 \times 10^3 \text{ m})$

   e. $(1.01 \text{ g})/((0.102 \text{ mm}) \times (0.0821 \text{ mm}) \times (12.1 \text{ mm}))$

   f. $((6.6262 \times 10^{-34} \text{ kg m}^2/\text{sec}) \times (2.998 \times 10^8 \text{ m/sec}))/(2.54 \times 10^{-9} \text{ m})$

A key component of being a good AP Chemistry student is problem solving and using dimensional analysis and units! To that end, answer the ensuing questions (4-9) using dimensional analysis – you may *look up any conversions that you think you need but you MAY NOT use conversions between squared or cubed units*. SHOW ALL work (with units) and DO NOT use proportions!

4. Carbon monoxide detectors sound an alarm when peak levels of carbon monoxide reach 100. parts per million (ppm). This level roughly corresponds to a composition of air that contains 4.0×10^5 μg of carbon monoxide per cubic meter of air (4.0×10^5 μg of CO/m^3 air). Assuming the dimensions of a room are 18 ft x 12 ft x 8.0 ft, give the mass in grams of carbon monoxide in the room that would make the alarm sound on a CO detector. Show all work (meaning all dimensional analysis steps – NO using proportions!!). You should look up (either in a book or on the internet) any conversions you need.

5. The density of pure silver is 10.5 g/cm^3 at 20°C. If 5.25 g of pure silver pellets is added to a graduated cylinder containing 11.2 mL of water, what will be the final volume measurement of the water in the cylinder? Show all work.

6. Above each square inch of the Earth's surface is 14.7 pounds of air. The density of air at sea level is about 1.27 g/L. The Earth is 7930 miles in diameter with a mass of 5.98×10^{24} kg.
   a. Determine the mass in kilograms of Earth's atmosphere (ie the air above its surface)
   b. Determine the average density of the Earth in grams per mL.

7. Suppose you have a cube of pure magnesium metal that has edges of 5.00 cm. Given that the density of Mg is 1.74 g/cm^3, how many atoms of magnesium are in the cube? Show all work and dimensional analysis.

8. The circumference of the Earth is 40,075 km. If you wanted a plane to be able to circumnavigate the Earth in 10.00 hours, how fast would the plane need to go in feet per second?

9. An empty 3.00-L bottle weighs 1.70 kg. Filled with a homemade wine, the bottle weighs 10.41 lbs. The wine contains 11.0% ethanol (C_2H_5OH) by mass.
   a. How many ounces of ethanol are present in 275 mL of this wine?
   b. How many total carbon atoms are in the 3.00 L of wine in the bottle?

10. One of the things that all AP Chemistry students should be familiar with are particulate diagrams. Label each box below with the appropriate description. You should use each choice only once. The choices are the following: solid element, liquid compound, mixture of a liquid element and compound, gaseous compound, solid compound, and mixture of a gas element and compound

_____   _____   _____

_____   _____   _____
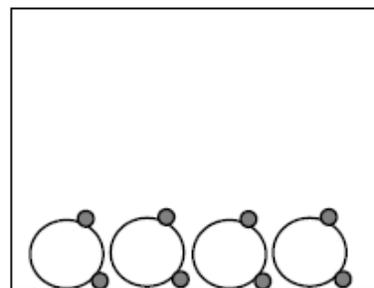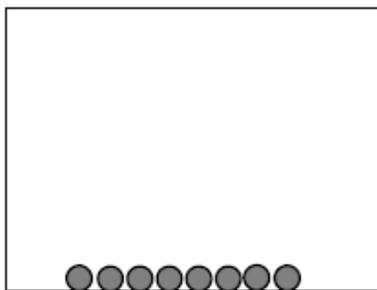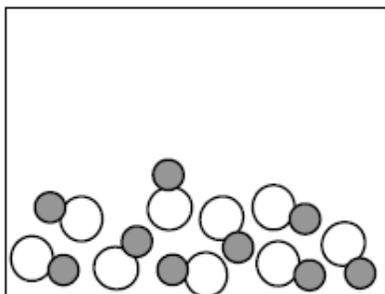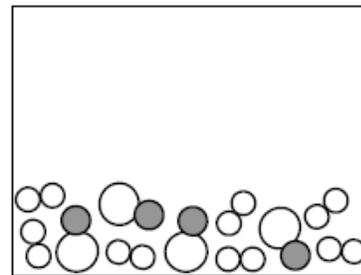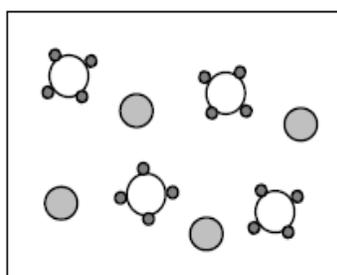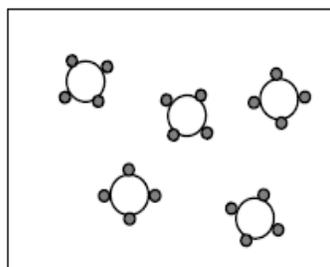
11. Ms. Van Liew uses the term "building block" to describe the basic unit of a pure substance – think about what you might see if you were the size of an atom and were looking at some piece of matter. For example, the building block of an element that is NOT diatomic would be an atom of that element. List the building block of the following:
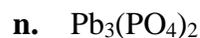
    a. The building block of water is called a water _____.

    b. The building blocks of sodium chloride are called (two words!)

    _____   _____.

    c. The building block of oxygen is called an oxygen _____.

    d. The building block of helium is called a helium _____.

    e. The building block of gold is called a gold _____.

12. Complete (fill in the blanks) the following table – each row represents one individual atom or ion:

Symbol	# of protons in nucleus	# of neutrons in nucleus	# of electrons	Mass number	Net charge
Fe^{2+}				53	
	26	33			3+
	85		86	210	
Al		14	10		
		76	54		2-

13. Naturally occurring boron is 80.20% boron-11 which has an atomic mass of 11.01amu. The remaining boron atoms exist as one other isotopic form. What is the mass number and atomic mass of this second isotope of boron? Show all work.

14. Give the correct chemical name for the following formulas.

    a. Hg_2O

    b. CoS

    c. NH_4NO_2

    d. ICl

    e. $KClO_3$

    f. Sr_3N_2

    g. SnO_2

    h. S_4N_4

    i. H_2O_2

    j. $AgNO_3$

    k. $FeBr_3$

    l. $TiCl_4$

    m. Co_2S_3

    n. $Pb_3(PO_4)_2$

    o. Sr_3N_2

    p. $Al_2(SO_3)_3$

    q. Na_2CrO_4

    r. $KMnO_4$

    s. H_2O

    t. $MgCr_2O_7$

15. Give the correct chemical formula for the following compound names

a. tin(II) nitride

b. mercury(II) oxide

c. diboron trioxide

d. chromium(III) carbonate

e. silver chromate

f. aluminum chlorite

g. cadmium nitrite

h. calcium sulfate

i. diphosphorus tetroxide

j. sodium hydrogen carbonate

k. cobalt(III) iodide

l. zinc chloride

m. sodium dihydrogen phosphate

n. ammonium acetate

o. potassium chlorate

p. sulfur hexachloride

q. manganese(IV) sulfide

r. silicon dioxide

s. cesium perchlorate

t. ammonia

16. Give the correct name for the following acids

a. $HC_2H_3O_{2(aq)}$

b. $H_2SO_{3(aq)}$

c. $HNO_{3(aq)}$

d. $HF_{(aq)}$

e. $HClO_{(aq)}$

17. Give the correct formula for the following acids

a. perbromic acid

b. iodous acid

c. hydrochloric acid

d. sulfuric acid

e. carbonic acid

18. Write a balanced chemical equation for each reaction described. ***Include states of matter symbols and make sure that your coefficients are whole numbers.***

    a. A red powder, mercury(II) oxide, is heated until it decomposes into a liquid metal and a colorless gas.

    b. Cyclohexane (C_6H_{12}) liquid is burned in air.

    c. Aluminum metal reacts with liquid bromine to produce a white solid.

    d. Aqueous sodium nitrate and solid lead(II) iodide are produced when two solutions are combined and a double replacement reaction occurs.

    e. Solids ammonium sulfide is produced from the reaction of ammonia gas and dihydrogen monosulfide gas.

19. Gaseous ammonia reacts with oxygen gas to produce nitrogen monoxide gas and water vapor.

    a. Write a balanced chemical equation. Include states and make sure your coefficients are whole numbers.

    b. 50.0 g of ammonia reacts with 50.0 g of oxygen.

        i. Who is the limiting reactant? Show all work CLEARLY!!

        ii. List the amounts (in grams) of EVERYTHING that is present once the reaction has gone to completion. Show all work.

20. Monosodium glutamate (MSG) is a food flavor enhancer. It has the following composition by mass: 35.51% carbon, 4.77% hydrogen, 37.85% oxygen, 8.29% nitrogen, and the rest sodium. Find the empirical formula for MSG. Show all work.

21. Vitamin C (aka ascorbic acid) is 40.92% carbon, 4.58% hydrogen, and 54.50% oxygen by mass. Find both the empirical and molecular formulas for vitamin C if a 500. mg tablet of vitamin C contains 1.71×10^{21} molecules of vitamin C. SHOW ALL WORK! Hint – you will need to use the information given to find the molar mass of vitamin C to get the molecular formula.

22. Myoglobin stores oxygen for metabolic processes in muscle. Chemical analysis shows that it contains 0.34% Fe by mass. Given that there is one Fe atom per molecule of myoglobin, what is the molar mass of myoglobin? Show all work and use dimensional analysis!!