

YOUR NAME: _____

I WORKED WITH: _____

AP CHEMISTRY SUMMER WORK PACKAGE 2021-2022

This is due no later than **Monday, August 9, 2021**. The original paper should be handed into the main Upper School office. You are welcome to work with other students on this packet but every student must hand in his/her own packet with all work shown.

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 may use the internet or other resources to get necessary information. If you are in doubt email Ms. Van Liew or Mrs. Beardsley.

- 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!

- Underline (do not just state how many!!)** the significant figures in each of the following numbers:
 - 100
 - 1.0×10^2
 - 100.
 - 1.00×10^3
 - 0.0048
 - 0.00480
 - 4.80×10^{-3}
 - 4.800×10^{-4}
 - 935,000

- Evaluate each of the following and write the answer to the appropriate number of **significant figures with correct units**.
 - $212.2 \text{ cm} + 26.7 \text{ cm} + 402.09 \text{ cm}$
 - $1.0028 \text{ g} + 0.221 \text{ g} + 0.10337 \text{ g}$
 - $52.331 \text{ mL} + 26.01 \text{ mL} - 0.9981 \text{ mL}$
 - $201\text{m} + 3014 \text{ m}$
 - $(1.01 \text{ g}) / ((0.102 \text{ mm}) \times (0.0821 \text{ mm}) \times (12.1 \text{ mm}))$
 - $((6.6262 \times 10^{-34} \text{ kg m}^2/\text{sec}) \times (2.998 \times 10^8 \text{ m/sec})) / (2.54 \times 10^{-9} \text{ m})$

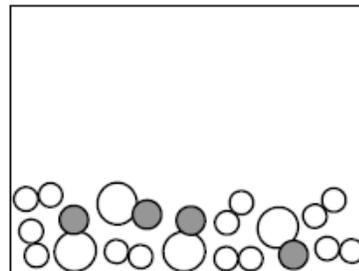
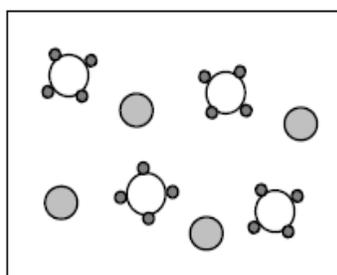
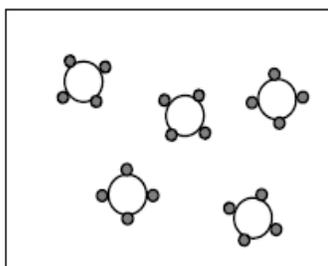
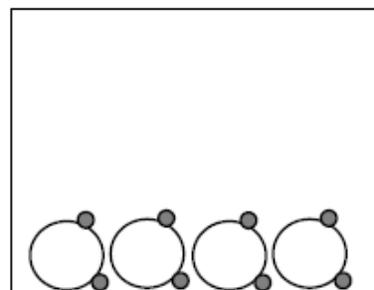
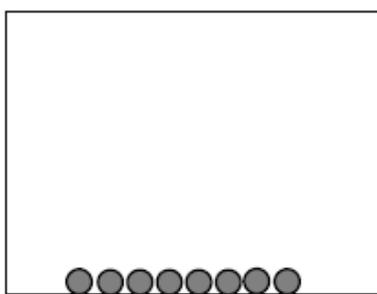
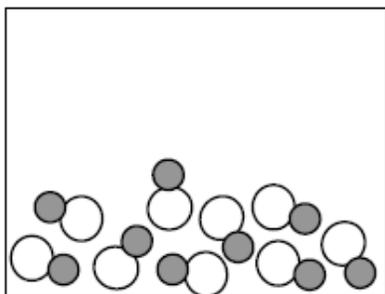
A key component of being a good AP Chemistry student is problem solving and using dimensional analysis and units! **To that end, answer the ensuing questions (4-9) using dimensional analysis – you may ****look up any conversions that you think you need but you MAY NOT use conversions between squared 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 $4.0 \times 10^5 \mu\text{g}$ of carbon monoxide per cubic meter of air ($4.0 \times 10^5 \mu\text{g}$ 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 but only for things like feet to meters – you may not look up relationships between squared or cubed units.

5. The density of pure silver is $10.5 \text{ g}/\text{cm}^3$ 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. A 1.0 mL volume of seawater contains about 4.0×10^{-12} g of gold. The total volume of ocean water is 1.5×10^{21} L.
 - a. Calculate the total number of gold atoms present in seawater.
 - b. The current price of gold is about \$1900 per ounce. Calculate the total worth of the gold present in seawater. Give your answer to the nearest dollar.

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. A certain volume of mercury has 2.50×10^{25} mercury atoms. Find this volume (in L) using dimensional analysis. You will need to know that the density of mercury is 13.6 g/cm^3 .
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

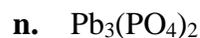


11. Complete (fill in the blanks) the following table – each row represents one individual atom or ion:

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-

12. 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.

13. Give the complete and correct chemical name for the following formulas.



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

- | | |
|------------------------------|--------------------------------|
| a. tin(II) nitride | k. cobalt(III) iodide |
| b. mercury(II) oxide | l. zinc chloride |
| c. diboron trioxide | m. sodium dihydrogen phosphate |
| d. chromium(III) carbonate | n. ammonium acetate |
| e. silver chromate | o. potassium chlorate |
| f. aluminum chlorite | p. sulfur hexachloride |
| g. cadmium nitrite | q. manganese(IV) sulfide |
| h. calcium sulfate | r. silicon dioxide |
| i. diphosphorus tetroxide | s. cesium perchlorate |
| j. sodium hydrogen carbonate | t. ammonia |

Problems 15-16 are about acid nomenclature – a reminder from the directions that you need to learn about to do this ON YOUR OWN – it is highly advised to TAKE NOTES from a book or website

15. Give the correct name for the following acids

- a. $\text{HC}_2\text{H}_3\text{O}_2(\text{aq})$
- b. $\text{H}_2\text{SO}_3(\text{aq})$
- c. $\text{HNO}_3(\text{aq})$
- d. $\text{HF}(\text{aq})$
- e. $\text{HClO}(\text{aq})$

16. Give the correct formula for the following acids

- a. perbromic acid
- b. iodous acid
- c. hydrochloric acid
- d. sulfuric acid
- e. carbonic acid

17. 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 (C₆H₁₂) 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. Solid ammonium sulfide is produced from the reaction of ammonia and dihydrogen monosulfide gases.

18. Propane, C₃H₈, is an organic compound, and is typically used as the fuel for gas grills.

- a. Write the balanced equation for the complete combustion of propane. Assume that all reactants and products are gases.
- b. A tank of propane initially weighs 78.8 kg. Mrs. Beardsley has a cook out and uses the tank for her grill. After the cook out the tank weighs 60.5 kg.
 - i. Given that the temperature was 30.0°C and the pressure was 745 mm Hg, calculate the volume of oxygen needed to combust the propane that was used. HINT – you will need to use your balanced equation and the ideal gas law. **SHOW ALL WORK!**
 - ii. Given that air is 21.0% oxygen, calculate the volume of air needed based on your above answer. Again – show all work.

- 19.** Gaseous ammonia reacts with oxygen gas to produce nitrogen monoxide gas and water vapor.
- Write a balanced chemical equation. Include states and make sure your coefficients are whole numbers.
 - 50.0 g of ammonia reacts with 50.0 g of oxygen.
 - Who is the limiting reactant? Show all work that proves this CLEARLY!!
 - List the amounts (in grams) of EVERYTHING that is present once the reaction has gone to completion. Show all work.

Problems 20-21 are about percent composition and empirical and molecular formulas – a reminder that you need to learn how to do these problems ON YOUR OWN either by watching the recording from the link in the directions or finding the information on line

- 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.