

KATONAH-LEWISBORO SCHOOLS
Union Free School District No. 1
Towns of Bedford, North Salem and Pound Ridge

June 1, 2018

Dear Prospective Advanced Placement Chemistry Student,

Welcome to the Advanced Placement Chemistry class for 2018-19!

In order to get a head start for the fall, I would like to issue your text to you at the end of *this* year and ask that you do some advance preparation over the summer. **Please see me no later than June 15 to sign out your copy of the text. I can be found in Q building (Q 201 or Q 202) periods 1-8.**

To prepare for next September you will need to read Chapters 1, 2 and 3 of the text: *Chemistry*, 9th edition by Zumdahl and complete the attached problem sets. In addition, I would like you to read and outline chapters 18 and 22 future use.

The exercises at the end of each chapter of the text have a two-color numbering system: blue problems provide an answer at the end of the text, but black problems do not. If you are having difficulty with a particular question, try a similar one from the text where the answer is provided and then apply a similar technique to your sticky problem.

Problem sets can be handwritten but please show all work! If you find you have a clarification question as you work through these, you can email me at ecamporese@klschools.org. I will check my email periodically over the summer and get back to you.

In September, the problem set packet and outlines will be collected and assessed to see where we need to spend time before jumping into the more advanced parts of the curriculum. The problem sets and outlines will not be formally graded, but they are a **mandatory 'admission ticket'** to the class. **You will have a quiz on the polyatomic ions within the first week of school.**

If you would like to get together with another AP student and work together on the exercises, it would be a good way to pace yourself over the summer. However, you will need to submit **separate, independent** work in September. The goals for this summer assignment are to keep you current with some chemistry basics, have you practice your problem-solving skills at a more relaxed pace, and give you a feel for the rigor of the course.

Have a well-deserved summer vacation and enjoy your chemistry text! I will see you in September!

Sincerely,

Mrs. Camporese

Chapter 1:

1. Determine the number of significant figures in each of the following:

a. 0.7540 _____

a. 12500 _____

c. 10000.01 _____

d. 1200 _____

e. 1.04×10^3 _____

f. 0.0080050 _____

2. Perform the following calculations and round to the appropriate number of significant figures:

a. $34.66 + 333.0$

b. $445 - 1.22$

c. 18.2×1.998

d. $10.2 \div 1.34$

e. $6.022 \times 10^{23} \times 2.33 \times 10^2$

f.
$$\frac{6.6262 \times 10^{-34} \times 2.998 \times 10^8}{2.54 \times 10^{-9}}$$

g.
$$\frac{2.0064 - 2.0033}{6.022 \times 10^{23}}$$

h.
$$\frac{9.875 \times 10^2 - 9.795 \times 10^2}{9.795 \times 10^2} \times 100 \quad (100 \text{ is an exact number})$$

3. Use dimensional analysis to make the following conversions:

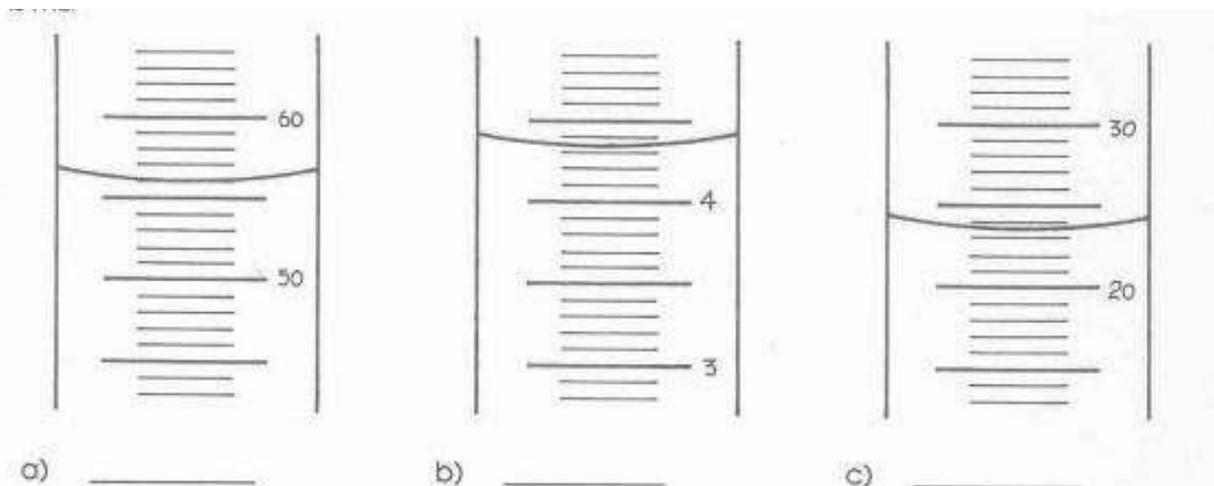
a. 289 centimeters to nanometers

b. 164 microliters to milliliters

c. 5.50 teragrams to kilograms

d. 8.0 cubic decimeters to liters

4. Precision in measurement: what volume is indicated in each graduated cylinder?
The unit is mL



5. To determine the volume of a cube, a student measured one of the dimensions of the cube several times. If the true dimension of the cube is 9.23 cm, give an example of four sets of measurements that would illustrate the following:

a. imprecise and inaccurate data

b. precise but inaccurate data

c. precise and accurate data

6. Give three examples illustrating each of the following terms:
- homogeneous mixture
 - heterogeneous mixture
 - compound
 - element
 - physical change
 - chemical change
7. A solid white substance A is heated strongly in the absence of air. It decomposes to form a new white substance B and a gas C. The gas has exactly the same properties as the product obtained when carbon is burned in an excess of oxygen. Based on these observations, can we determine whether solids A and B and gas C are elements or compounds? Explain your conclusions for each substance.
8. In the process of attempting to characterize a substance, a chemist makes the following observations: the substance is silvery-white, lustrous, melts at 649°C , boils at 1105°C and has a density of 1.738 g/cm^3 at 20°C . The substance burns brilliantly in air to produce an intense white light and reacts with chlorine gas to produce a brilliant white solid. The substance can be drawn into wires, pounded into thin sheets and is a good conductor of electricity. Which of these characteristics are physical properties and which are chemical properties?

9. a. Tetrachloroethylene is a liquid used in dry-cleaning that is being phased out because of its potential to cause cancer. A sample has a mass of 40.55 g and a volume of 25.0 mL at 20°C. What is its density? Will tetrachloroethylene float on water?
- b. A 100. mL sample of ethanol ($d = 0.789 \text{ g/cm}^3$) is dissolved in 1.00L of benzene ($d = 0.880 \text{ g/cm}^3$). What is the mass of the mixture?
10. Carbon monoxide (CO) 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 400,000 μg of carbon monoxide per cubic meter of air ($400,000 \mu\text{g/m}^3$). Assuming the dimensions of a room are 18 ft x 12 ft x 8 ft, estimate the mass of carbon monoxide in the room that would register 100 ppm on a carbon monoxide detector.

Chapter 2:

1. A chemist finds that 30.82 g of nitrogen will react with 17.60g, 35.20g, 70.40g or 88.00g of oxygen to form four different compounds.

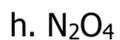
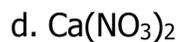
a. What is the mass of oxygen per gram of nitrogen in each compound?

b. How does the information in part a support Dalton's atomic theory?

2. Complete the following table:

Symbol	Number of Protons	Number of Electrons	Number of Neutrons	Net Charge
${}^{31}\text{P}^{3-}$				
	34		45	2-
	50	46	69	
		76	118	3+
${}^{53}\text{Fe}^{2+}$				

3. Identify each of the following as ionic or molecular:



4. Name the following compounds:

a. LiCl		g. CO	
b. $\text{Mg}(\text{OH})_2$		h. CBr_4	
c. K_3P		i. FeS	
d. Fe_2O_3		j. $\text{HC}_2\text{H}_3\text{O}_2$	
e. SO_2		k. NaCN	
f. HNO_2		l. $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$	

5. Write the formula for the following compounds:

a. tin(II) bromide		f. nickel(II) perchlorate	
b. potassium sulfate		g. tetraphosphorus decoxide	
c. nitrogen tribromide		h. xenon hexafluoride	
d. phosphoric acid		i. dicarbon tetrafluoride	
e. sodium hydroxide		j. hydrobromic acid	
f. chromium (III) nitride		k. calcium chlorate	

6. For the following atomic numbers, use the periodic table to determine the formula (include the charge) for the ion that the element is most likely to form in an ionic compound.

a. 13 _____

d. 7 _____

b. 34 _____

e. 87 _____

c. 56 _____

f. 35 _____

7. Explain the following three laws and include an example to illustrate:

a. the law of conservation of mass:

b. the law of definite proportion

c. the law of multiple proportions

Chapter 3:

Questions 1 and 2 deal with the following situation: You react chemical A with chemical B to make one product. It takes 100 g of A to react completely with 20 g of B.

1. What is the mass of the product?
 - a. less than 10 g
 - b. between 20 and 100 g
 - c. between 100 and 120 g
 - d. exactly 120 g
 - e. more than 120 g

2. What is true about the chemical properties of the product?
 - a. The properties are more like chemical A.
 - b. The properties are more like chemical B.
 - c. The properties are an average of those of chemicals A and chemical B.
 - d. The properties are not necessarily like either chemical A or chemical B.
 - e. The properties are more like chemical A or more like chemical B, but more information is needed.

Justify your choice and explain what is wrong with the other four choices.

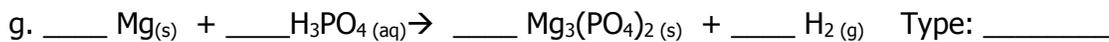
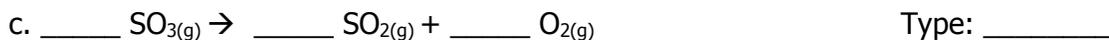
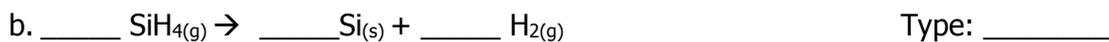
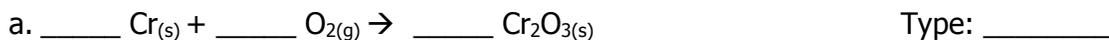
3. Which (if any) of the following is (are) *true* regarding the limiting reactant in a chemical reaction?
 - a. The limiting reactant has the lowest coefficient in a balanced equation.
 - b. The limiting reactant is the reactant for which you have the fewest number of moles.
 - c. The limiting reactant has the lowest ratio of moles available/coefficient in the balanced equation.
 - d. The limiting reactant has lowest ratio of coefficient in the balanced equation/moles available.

Justify your choice and explain what is wrong with any that you did not choose.

3. Naturally occurring magnesium has the following isotopic abundances. Calculate the average atomic mass of magnesium.

Isotope	Abundance (%)	Atomic mass (amu)
^{24}Mg	78.99	23.98504
^{25}Mg	10.00	24.98584
^{26}Mg	11.01	25.98259

4. Balance the following equations using the smallest coefficients and indicate the reaction type. Choose from: decomposition (D), single replacement (SR), double replacement (DR), synthesis (S), or combustion (C):



5. Write a balanced chemical equation for the following reactions:

- a. When solid calcium carbonate is heated, solid calcium oxide and gaseous carbon dioxide are formed.

- b. When solid mercury (II) sulfide is heated with oxygen, liquid mercury metal and gaseous sulfur dioxide are produced.

- c. When aqueous solutions of aluminum sulfate and barium chloride are mixed, solid barium sulfate and aqueous aluminum chloride are formed.

- d. Solid sodium bicarbonate reacts with hydrochloric acid to produce sodium chloride, water, and carbon dioxide gas.

- e. Gaseous ammonia and oxygen react to produce nitrogen monoxide gas and water vapor.

6. Moles and Stoichiometry:

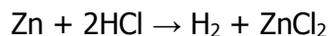
a. Vinegar is a dilute solution of acetic acid, CH_3COOH .

i. Calculate the molar mass of acetic acid

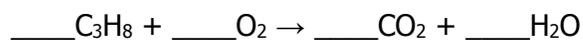
ii. How many molecules of CH_3COOH are contained in 43.4 g of acetic acid?

ii. What is the mass of 0.450 mol of acetic acid?

- b. How many moles of hydrogen gas can be produced if 1.35 g of solid zinc reacts with excess hydrochloric acid according to the equation?



- c. The reaction for the combustion of propane is:



If 20.0 g of C_3H_8 and 20.0 g of O_2 are reacted, how many moles of CO_2 can be produced?

7. What is the percentage by mass of each element in glucose, $\text{C}_6\text{H}_{12}\text{O}_6$?

8. The analysis of a rocket fuel showed that it contained 87.4% nitrogen and 12.6 % hydrogen by mass. Mass spectra analysis shows that the fuel has a molar mass of 32.05 g. What are the empirical and molecular formulae of the fuel?