A.P. Chemistry Summer Work

You are responsible for chapters 1-3 this summer. The material in these chapters is what I **expect** you to know from first year chemistry, so it is important for you to complete the work. There will be a test on these chapters the first week we are back!

The following review problems should be completed this summer:

Chapter 1

1. Liquid Nitrogen is used as a commercial refrigerant to flash freeze foods. Nitrogen boils at -196°C. What is the temperature on the Kelvin temperature scale?

2. How many significant figures do the following measured quantities have?

a) 27.53 cm   d) 0.00021 kg

b) 39.240 cm   e) 0.06080 m

c) 102.0 cm   f) 0.0002 L

3. Perform the following arithmetic and round off the answers to the correct number of significant figures. Assume that all of the numbers were obtained by measurement.

a) 0.0022 x 315   d) (22.4 + 102.7 + 0.005) / (5.478)

b) 83.25 — 0.01075   e) (315.44 — 208.1) X 7.223

c) (84.45 — 0.02) / (31.2 x 9.8)

4. Perform the following conversions.

a) 32.0 dm to km   d) 137.5 mL to L

b) 8.2 mg to ug   e) 0.55 dm to km

c) 75.3 mg to kg   f) 342 pm to dm

5. If a person is 6 ft 2 in. tall, what is the person's height in centimeters?

6. A bullet is fired at a speed of 2235 ft/s. What is this speed expressed in kilometers per hour?

7. Chloroform, a chemical once used as an anesthetic, has a density of 1.492 g/mL. What is the mass in grams of 185 mL of chloroform?

8. A graduated cylinder was filled with water to the 15.0-mL mark and weighed on a balance. Its mass was 27.35 g. An object made of silver was placed in the cylinder and completely submerged in the water. The water level rose to 18.3 mL. When reweighed, the cylinder, water, and silver object had a total mass of 62.00 g. Calculate the density of silver with proper sig figs.

9. Distances between starts are often expressed in units of *light-years*. A light-year is the distance that light travels during 1 year. Use the factor-label method to calculate the number of miles in one light-year, given that light travels at a speed of 3.0×10^8 meters per second. [*Hint*: Begin with *1 year* (365 days) and then use conversion factors to change that to a distance traveled by light.]

Chapter 2

1. Write the symbols of the isotopes that contain the following.

a) An isotope of iodine whose atoms have 78 neutrons.

b) An isotope of strontium whose atoms have 52 neutrons.

c) An isotope of cesium whose atoms have 82 neutrons.

d) An isotope of fluorine whose atoms have 9 neutrons.

2. Which of the following is

a) an alkali metal? Ca, Cu, In, Li, S

b) a halogen? Ce, Hg, Si, O, I

c) a transition element? Pb, W, Ca, Cs, P

d) a noble gas? Xe, Se, H, Sr, Zr

e) a lanthanide element? Th, Sm, Ba, D, Sb

f) an alkaline earth metal? Mg, Fe, K, Cl, Ni
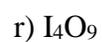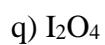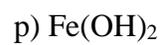
3. Name the following.

a) $CrCl_2$ b) NH_4NO_2

c) KIO_3 d) $HClO_2$

e) $CaSO_3$ f) $AgCN$

g) $ZnBr_2$

h) H_2Se (g)

i) H_2Se (aq)

j) $V(NO_3)_3$

k) $Co(C_2H_3O_2)_2$

l) Au_2S_3

m) Au_2S

n) $GeBr_4$

o) K_2CrO_4

p) $Fe(OH)_2$

q) I_2O_4

r) I_4O_9

s) P_4Se_3

4. Write formulas for the following.

a) sodium monohydrogen phosphate

b) lithium selenide

c) sodium hydride

d) chronic acetate

e) nickel (II) cyanide

f) iron (III) cyanide

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g) tin (II) sulfide　　　　　　　　　　　　　　　　　h) antimony pentafluoride

i) dialuminum hexachloride　　　　　　　　　　　j) tetraarsenic decoxide

k) magnesium hydroxide　　　　　　　　　　　　l) copper (II) bisulfate

m) ammonium thiocyanate　　　　　　　　　　　n) potassium thiosulfate

Chapter 3

1. How many moles of Al atoms are needed to combine with 1.58 of O atoms to make aluminum oxide, Al_2O_3.

2. How many moles of H_2 and N_2 can be formed by the decomposition of 0.145 mol of ammonia, NH_3.

3. What is the total number of atoms in 0.260 mol of glucose, $C_6H_{12}O_6$?

4. Calculate the mass in grams of the following.

a) 1.25 mol $Ca_3(PO_4)_2$　　　　　　　　　　　　b) 0.625 mol $Fe(NO_3)_3$

c) 0.600 mol C_4H_{10}　　　　　　　　　　　　　d) 1.45 mol $(NH_4)_2CO_3$

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5. Calculate the number of moles of each compound in the following samples.

a) 21.5 g $CaCO_3$ b) 1.56 g NH_3

c) 4.29g H_2O_2 d) 4.65 ug Na_2CrO_4

6. Calculate the percentage composition by mass for each of the following:

a) NaH_2PO_4 b) $NH_4H_2PO_4$

c) $(CH_3)_2CO$ d) $CaSO_4$

e) $CaSO_4 \cdot 2H_2O$

7. It was found that 2.35 g of a compound of phosphorus and chlorine contained 0.539 g of phosphorus. What are the percentages by mass of phosphorus and chlorine in this compound?

8. Phencyclidine ("angel dust") is $C_{17}H_{25}N$. A sample suspected of being this illicit drug was found to have a percentage composition of 83.71% C, 10.42% H, and 5.61% N. Do these data acceptably match the theoretical data for phencyclidine?

9. Quantitative analysis of a sample of sodium pertechnetate with a mass of 0.896 g found 0.111 g of sodium and 0.477 g of technetium. The remainder was oxygen. Calculate the empirical formula of sodium pertechnetate, arranging the atomic symbols in the formula in the order of NaTcO. (Radioactive sodium pertechnetate is used as a brain-scanning agent in medicine.)
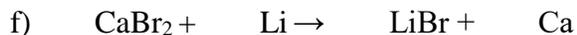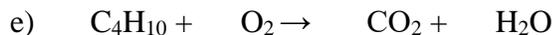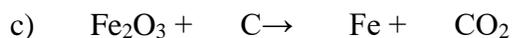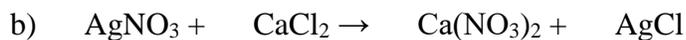
10. A dry-cleaning fluid composed of only carbon and chlorine was found to be composed of 14.5% C and 85.5% Cl (by mass). What is the empirical formula of this compound?

11. A substance was found to be composed of 22.9% Na, 21.5% B, and 55.7% O. What is the empirical formula of this compound?

12. A sample of a compound of mercury and bromine with a small of 0.389 g was found to contain 0.111 g bromine. Its molecular mass was found to be 561. What are its empirical and molecular formulas?

13. A sample of a compound of C, H, N, and O, with a mass of 0.6216 g was found to contain 0.1735 g C, 0.01455 g H, and 0.2024 g N. Its formula mass is 129. Calculate its empirical and molecular formulas, arranging their symbols in alphabetical order.

14. Balance the following equations, and tell what type of reaction they are. (Single Replacement, Decomposition…)

a) $Ca(OH)_2$ + $HCl \rightarrow$ $CaCl_2$ + H_2O

b) $AgNO_3$ + $CaCl_2 \rightarrow$ $Ca(NO_3)_2$ + $AgCl$

c) Fe_2O_3 + $C \rightarrow$ Fe + CO_2

d) $NaHCO_3$+ $H_2SO_4 \rightarrow$ Na_2SO_4 + H_2O+ CO_2

e) C_4H_{10} + $O_2 \rightarrow$ CO_2 + H_2O

f) $CaBr_2$ + $Li \rightarrow$ $LiBr$ + Ca

g) $CaCO_3 \rightarrow$ CaO + CO_2

15. The incandescent white of a fireworks display is caused by the reaction of phosphorous with O_2 to give P_4O_{10}.

a) Write the balanced chemical equation for the reaction.

b) How many grams of O_2 are needed to combine with 6.85 g of P?

c) How many grams of P_4O_{10} can be made from 8.00 g of O_2?

d) How many grams of P are needed to make 7.46 g of P_4O_{10}?

16. The reaction of powdered aluminum and iron (III) oxide, $2Al + Fe_2O_3 \rightarrow Al_2O_3 + 2Fe$, produces so much heat the iron that forms is molten. Because of this, railroads use the reaction to provide molten steel to weld steel rails together when laying track. Suppose that in one batch of reactants 4.20 mol of Al was mixed with 1.75 mol of Fe_2O_3.

a) Which reactant, if either, was the limiting reactant?

b) Calculate the number of grams of iron that cane formed from the mixture of reactants.

17. Silver nitrate, $AgNO_3$, reacts with iron (III) chloride, $FeCl_3$, to give silver chloride, $AgCl$, and iron (III) nitrate, $Fe(NO_3)_3$. A solution containing 18.0 g of $AgNO_3$ was mixed with a solution containing 32.4 g of $FeCl_3$. How many grams of which reactant remains after the reaction is over?

18. Calculate the molarity of a solution prepared by dissolving

a) 4.00 g of NaOH in 100.0 mL of solution.

b) 16.0 g of $CaCl_2$ in 250.0 mL of solution.

c) 14.0 g of KOH in 75.0 mL of solution.

d) 6.75 g of $H_2C_2O_4$ in 500 mL of solution.

19. Calculate the number of grams of each solute that has to be taken to make each of the following solutions.

a) 125 mL of 0.200 M NaCl

b) 250 mL of 0.360 M $C_6H_{12}O_6$ (glucose)

c) 250 mL of 0.250 M H_2SO_4

20. If 25.0 mL of 0.56 M H_2SO_4 is diluted to a volume of 125 mL, what is the molarity of the resulting solution?

21. To what volume must 25.0 mL of 18.0 M H_2SO_4 be diluted to produce 1.50 M H_2SO_4?

22. How many milliliters of water must be added to 150 mL of 2.5 M KOH to give a 1.0 M solution? (Assume volumes are additive.)

23. What is the molarity of an aqueous solution of potassium hydroxide if 21.34 mL, is exactly neutralized by 20.78 mL of 0.116 M HCL by the following reaction?

$$KOH_{(aq)} + HCl_{(aq)} \rightarrow KCl_{(aq)} + H_2O$$
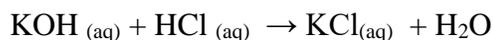
24. How many milliliters of 0.25 M $NiCl_2$ solution are needed to react completely with 20.0 mL of 0.15 M Na_2CO_3 solution? How many grams of $NiCO_3$ will be formed? The reaction is

$$Na_2CO_{3(aq)} + NiCl_{2(aq)} \rightarrow NiCO_{3(aq)} + 2NaCl_{(aq)}$$
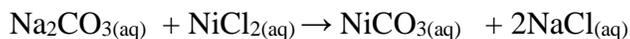
25. How many milliliters of 0.100 M NaOH are needed to completely neutralize 25.0 mL of 0.250 M H_3PO_4? The reaction is

$$3NaOH_{(aq)} + H_3PO_{4(aq)} \rightarrow Na_3PO_{4(aq)} + 3H_2O_{(aq)}$$
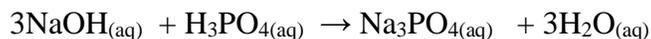
For 26-35, complete and balance the equations. Note states.

26.   Al + $Cl_2 \rightarrow$

27. $Pb(NO_3)_2$ +   KI $\rightarrow$

28. Na_2CO_3 +   HCl $\rightarrow$

29. N_2O_5 + $H_2O \rightarrow$

30. $Ba(NO_3)_2$ + $FeSO_4 \rightarrow$

31. $AgNO_3$ + $K_3PO_3 \rightarrow$

32. $(NH_4)_2S$ + $HC_2H_3O_2 \rightarrow$

33. $ZnCO_3$ +   HCl $\rightarrow$

34. $Ba(NO_3)_2$ + $(NH_4)_2CO_3 \rightarrow$

35.   CaO $\rightarrow$