AP CHEMISTRY SUMMER ASSIGNMENT

Answer all questions on a separate sheet of paper and show all work. Due the first Tuesday of school.

1. Perform the following mathematical operations and express the result to the correct number of significant figures.

$$\frac{6.63643 \times 10^{-34} \times 2.998 \times 10^{8}}{2.54 \times 10^{-9}}$$

2. How would we write 1000 to 1 significant figure?

    2 significant figures?

    3 significant figures?

    4 significant figures?

3. The density of osmium(the densest metal) is 22.57g/mL. If a 1.00 kg rectangular block of osmium has two dimensions of 4.00 cm x 4.00 cm, calculate the third dimension of the block.

4. Fill in the missing information.

Symbol	# protons	# neutrons	# electrons	Net Charge
^{238}U				
	20	20		+2
	23	28	20	
^{89}Y				
	15	16		-3

5. Chlorine exists mainly as two isotopes, ^{37}Cl and ^{35}Cl. Which is more abundant? Explain your answer.

6. You react chemical A with chemical B to make one product. It takes 100g of A to react completely with 20 g of B. What is the mass of the product?

7. How many moles are in each of these samples?
    a. 150.0 g Fe_2O_3
    b. 10.0 mg NO_2
    c. 1.5 x 10^{16} molecules of BF_3

8. How many atoms of carbon are present in 1.0 g of
   a. CH_4O
   b. $C_6H_{12}O_6$

9. Arrange the following substances in order of increasing percent phosphorus (by mass).
   a. Na_3PO_4 b. PH_3 c. P_4H_{10}

10. Determine the molecular formulas to which the following empirical formulas and molar masses (molecular weights) pertain:
    a. $NPCl_2$ (188.35 g/mole)
    b. CoC_4O_4 (341.94 g/mole)

11. A compound that contains only carbon, hydrogen and oxygen is 48.38 %C, and 8.12% H by mass. What is the empirical formula for this substance?

12. There are two compounds that contain only mercury and oxygen. Heating either of them results in the decomposition of the compound, with oxygen gas escaping into the atmosphere while leaving a residue of pure mercury. Heating 0.6498g of one of the compounds leaves a residue of 0.6018 g. Heating 0.4172 g of the other compound results in a mass loss of 0.016g. Determine the empirical formula of each compound.

13. Many homes in rural America are heated with propane gas, a compound that contains only carbon and hydrogen. Complete combustion of a sample of propane produced 2.641 g of carbon dioxide and 1.442 g of water as the only products. Find the empirical formula of propane.

14. Give the balanced equation for the following reactions:
    a. Glucose ($C_6H_{12}O_6$) reacts with oxygen gas to form gaseous carbon dioxide and water vapor.
    b. Solid iron (III) sulfide reacts with gaseous hydrogen chloride

15. Ammonia is produced from the reaction of nitrogen and hydrogen as follows:
$$3H_2(g) + N_2(g) \longrightarrow 2NH_3(g)$$

    a. What is the maximum mass of ammonia that can be produced from a mixture of 1.00 x 10^3 g of nitrogen and 5.00 x 10^2 g of hydrogen?

    b. What mass of starting material would remain unreacted?

16. When copper is heated with an excess of sulfur, copper (I) sulfide is formed. In a given experiment, 1.50 g of copper was heated with excess sulfur to yield 1.76 g of copper (I) sulfide. What is the theoretical yield of copper (I) sulfide. What is the percent yield?

17. Show how each of the following strong electrolytes dissociates into its component ions upon dissolving in water.   Ex. $HI \longrightarrow H^+ + I^-$
    a. NaBr
    b. $MgCl_2$
    c. $Al(NO_3)_3$
    d. $(NH_4)_2SO_4$

18. Calculate the molarity of each of these solutions.
    a. A 5.623 g sample of $NaHCO_3$ is dissolved in enough water to make 250.0 mL of solution.
    b. A 0.1025 g sample of copper metal is dissolved in 35 mL of concentrated nitric acid to form Cu^{+2} ions and then water is added to make a total volume of 200.0 mL. Calculate the molarity of Cu^{+2}.

19. Describe how you would prepare 1.0 L of each of the following solutions.
    a. 0.10M NaCl from solid NaCl
    b. 0.20 M NaCl from a 2.5 M stock solution

20. Calculate the concentration of all of the ions present in a 0.0020M $Al_2(SO_4)_3$ solution.

21. A 25.00 mL sample of hydrochloric acid requires 24.16 mL of 0.106M sodium hydroxide for complete neutralization. What is the concentration (molarity) of the original hydrochloric acid solution? (titration)

22. The steel reaction vessel of a bomb calorimeter, which has a volume of 75 mL is charged with oxygen gas to a pressure of 145 atm at 22 degrees Celcius. Calculate the moles of oxygen in the reaction vessel.

23. A particular balloon is designed by its manufacturer to be inflated to a volume of no more than 2.5L. If the balloon is filled with 2.0 L of helium at sea level, is released and rises to an altitude where the atmospheric pressure is only 500 mmHg, will the balloon burst? (assume temperature is constant).

24. Suppose two 200.0 L tanks are to be filled separately with the gases helium and hydrogen, respectively. What mass of each gas is needed to produce a pressure of 135 atm in its respective tank at 24.0 degrees Celcius?

25. A person accidentally swallows a drop of liquid oxygen (O_2), which has a density of 1.149 g/mL. Assuming that a drop has a volume of 0.050 mL, what volume of gas will be produced in the person's stomach at body temperature (37 °C) and a pressure of 1 atm?

26. An unknown diatomic gas has a density of 3.164 g/L at STP. What is the identity of this gas?

27. Write the electron configuration for each of the following:
   a. The smallest halogen atom
   b. The alkali metal with only 2 p and 3p electrons
   c. The group 3A element in the same period as Sn
   d. The nonmetallic elements in group 4A

28. Arrange the following groups of atoms in order of increasing size
   a. Be, Mg, Ca
   b. Te, I, Xe

29. For each of the following pairs of elements (Li and K) (S and Sc) pick the atom with
   a. The more favorable (exothermic) electron affinity
   b. The higher ionization energy
   c. The larger size

30. Which of the following ions have noble gas electron configurations?
   a. Fe^{+2}, Fe^{+3}, Sc^{+3}, Co^{+3}
   b. Tl^{+}, Te^{-2}, Cr^{+3}
   c. Pu^{+4}, Ce^{+2}, Ti^{+4}
   d. Ba^{+2}, Pt^{+2}, Mn^{+2}

31. Draw the Lewis structure for the following. Carbon is the central atom for CH_4, Nitrogen is the central atom NH_3, and oxygen is the central atom in H_2O.
   a. F_2 b. O_2 c. CH_4 d. NH_3 e. H_2O

32. Finish and balance the following reactions:
   a. C_3H_8 + O_2 ⟶
   b. KCl + F_2 ⟶
   c. $Ca(NO_3)_2$ + $Al_2(SO_4)_3$ ⟶
   d. Sodium oxide + barium chloride ⟶
   e. Ammonium sulfide + boron carbonate ⟶
   f. MgO ⟶
   g. Al + O_2 ⟶

33. List the strong acids and strong bases.

Know the polyatomic ions.

If you believe there is a typographical error in one of the questions/problems, please let me know via email at tslaven@canfieldschools.net.