AP Chemistry – Mr. Montero – Problem Set

1) Convert 10.49 g/ml to lb/in^3

2) Hemoglobin ($C_{2952}H_{4664}N_{812}O_{832}S_8Fe_4$) is the oxygen carrier in blood.

(a) Calculate the molar mass of hemoglobin

(b) An average adult has about 5.0 L of blood. Every milliliter of blood has approximately 5.0×10^9 erythrocytes, or red blood cells, and every red blood cell has about 2.8×10^8 hemoglobin molecules. Calculate the mass of hemoglobin molecules in grams in an average adult (ans: 7.6×10^2 g)

3) The density of an acid solution is 1.321 g/cm^3. The solution is 29.9% acid by mass (that means there are 29.9 g of acid for every 100 g of solution). What volume of the solution contains 100.0 g of pure acid?

4) The total volume of seawater is 1.5×10^{21} L. Assume that sea water contains 3.1 percent sodium chloride by mass and that its density is 1.03 g/mL. Calculate the total mass of sodium chloride in the ocean in tons (1 ton = 2000 lb; 1 lb = 453.6 g)

5) An aqueous solution of oxalic acid ($H_2C_2O_4$) is 0.568 M and has a density of 1.022 g/mL. What is the molality of the solution?

6) What is the molarity of a solution prepared by diluting 25.0 mL of 0.400 M potassium hydroxide (KOH) to 2.67 L?

7) What would be the molarity of a solution obtained when 275 mL of 6.00 M sodium hydroxide (NaOH) solution is mixed with each of the following?

a) 3.245 L of H_2O b) 125 mL of 6.00 M NaOH solution

8) A solution is prepared by dissolving 1.00 g of $CuSO_4 \bullet 5\ H_2O$ (Copper Sulfate pentahydrate) in enough water to make 10.00 mL of solution. A 1.00 mL portion of this solution is then diluted to a final volume of 10.00 mL. What is the molarity of the final $CuSO_4$ solution?

9) 500 ml of a Sulfuric Acid (H_2SO_4), is prepared using 100 ml of the Stock Solution. The Stock Solution has a density of 1.84 g/mL and a concentration of 98% (m/m). What is the molarity of the solution?

10)Hematite, Fe_2O_3, is the most common iron ore. How many moles of hematite are in an ore sample that contains 355 g of iron? Assume hematite is the only source of iron in this ore.

11) What is the molarity of the chloride ion in 250 mL of a solution containing 1.90 g of $MgCl_2$? (The molar mass of $MgCl_2$ is 95.2 g mol^{-1})

12) For each solution, identify the ions that exist in aqueous solution & specify the concentration of each.

a) 0.25 M $(NH_4)_2SO_4$ b) 0.123 M Na_2CO_3

13) I. $2\ Mn^{2+} + 4\ OH^- + O_2(g) \rightarrow 2\ MnO_2(s) + 2\ H_2O$

II. $MnO_2(s) + 2\ I^- + 4\ H^+ \rightarrow Mn^{2+} + I_2(aq) + 2\ H_2O$

III. $2\ S_2O_3^{2-} + I_2(aq) \rightarrow S_4O_6^{2-} + 2\ I^-$

The reactions above occur in order. The product of the first reaction, MnO_2 reacts with iodide to form I_2. The iodine reacts with thiosulfate to form $S_4O_6^{2-}$.

(a) According to the equation above, how many moles of $S_2O_3^{2-}$ are required to react with 1.00 mole of O_2?

(b) If 4.86 milliliters of a 0.0112-molar $Na_2S_2O_3$ solution completely reacts in reaction III, what is the number of moles of O_2 that reacted?

14) A 1.25-g sample contains some of the very reactive compound $Al(C_6H_5)_3$. On treating the compound with aqueous HCl, 0.951 g of C_6H_6 is obtained.

$$Al(C_6H_5)_3(s) + 3HCl(aq) \rightarrow AlCl_3(aq) + 3C_6H_6(l)$$

Assuming that $Al(C_6H_5)_3$ was converted completely to products, what is the weight percent of $Al(C_6H_5)_3$ in original 1.25-g sample?

15) In the photographic developing process, silver bromide is dissolved by adding sodium thiosulfate:

$$AgBr(s) + 2\ Na_2S_2O_3(aq) \rightarrow Na_3Ag(S_2O_3)_2(aq) + NaBr(aq)$$

If you want to dissolve 0.250 g of AgBr, what volume of 0.0138 M $Na_2S_2O_3$, in milliliters, should be used?

16) Chlorine is used to disinfect swimming pools. The accepted concentration for this purpose is 1 ppm chlorine, or 1 g of chlorine per million grams of water. Calculate the volume of a chlorine solution (in milliliters) a home owner should add to her swimming pool if the solution contains 6.0 percent chlorine by mass (6 g of chlorine per 100 g of solution) and there are 2.0×10^4 gallons of water in the pool. (1 gallon = 3.79 L; density of all liquids = 1.0 g/mL.) (ans = 1.3×10^3 mL.)

17) Tums is a popular remedy for acid indigestion. A typical Tums tablet contains calcium carbonate plus some inert substances. When ingested, it reacts with the gastric juice (hydrochloric acid) in the stomach to give off carbon dioxide gas. When a 1.328 g tablet reacted with 40.00 mL of hydrochloric acid (density = 1.140 g/mL), carbon dioxide gas was given off and the resulting solution weighed 46.699 g. Calculate the number of liters of carbon dioxide gas released if its density is 1.81 g/L. (ans = 0.13 L)