Chemistry 111 Review Sheet #4

1. State the hybridization of the central atom in the following compounds;
   CH_4, NH_3, CH_2O, HCN, C_2H_4
2. Argon gas is an inert carrier gas that moves other gases through a research or industrial system. What is the volume occupied by 4.2 kg of argon gas at SATP? (2.6 kL)
3. Freon gas is a chlorofluorocarbon (CFC) used as a coolant in air conditioners and refrigerators. If 500. L of Freon at 1.50 atm and 24°C is compressed to 250 mL at 3.50 atm. What is the final temperature of the gas? (74°C)
4. One of the most common uses of carbon dioxide gas is carbonating beverages such as soft drinks.
   a. What is the new volume of a 300 L sample of carbon dioxide gas when the pressure doubles? (150 L)
   b. What is the new volume of a 300 L sample of carbon dioxide when the temperature increases from 30°C to 60°C? (330 L)
   c. What is the molar volume of carbon dioxide gas at 22°C and 94.0 kPa? (26.1 L/ mol)
5. Pressurized hydrogen gas is used to fuel some prototype automobiles. What is the new volume of a 28.8 L sample of hydrogen in which the pressure is increased from 100 kPa to 350 kPa? (8.23 L)
6. What is the volume occupied by 1.0 g of carbon dioxide gas trapped in bread dough at SATP? (0.56 L)
7. Steam production during baking is a secondary reason why bread and cakes rise. What volume of water vapour is produced inside a cake when 1.0 g of water is vapourized at 98°C and 103 kPa? (1.7 L)
8. Bromine is produced by reacting chlorine with bromide ions in seawater. What amount of bromine is present in an 18.8 L sample of gas at 60 kPa and 140°C? (0.33 mol)
9. Convert the following;
   A 10 mL of 0.350 mol/L sulfuric acid into an amount in moles (0.35 mmol)
   B 15.0 kg of sodium hydroxide into amount in moles (0.375 kmol)
   C 10. L of methane gas at SATP into an amount in moles (0.40 mol)
   D 5.1 mol of ammonia gas at 30°C and 1100 kPa into volume (12 L)
   E 15 mmol of potassium dichromate into a mass equivalent (4.4 g)
10. Standard solutions of sodium oxalate are used in a variety of chemical analyses. What mass of sodium oxalate is required to prepare 250.0 mL of a 0.375 mol/L solution? (12.6 g)
11. Calculate the volume of concentrated phosphoric acid (14.6 mol/L) that must be diluted to prepare 500. mL of a 1.25 mol/L solution. (42.8 mL)
12. Isooctane, $C_8H_{18(l)}$, is one of the main constituents of gasoline. Calculate the mass of carbon dioxide gas produced by the complete combustion of 692 g of isooctane. (2.13 kg)
13. Analysis shows that 9.44 mL of 50.6 mmol/L KOH(aq) is needed for the titration of 10.00 mL of water from an acidic lake. Determine the molar concentration of acid in the lake water, assuming that it is sulfuric acid. (23.9mmol)
14. Determine the molecular formula for nicotine from the following evidence.
    Molar mass = 162. 24 g/mol
    Percent by mass C = 74.0 %
    Percent by mass H = 8.7 %
    Percent by mass N = 17.3 % ($C_{10}H_{14}N_2$)
15. Given the following information, determine the molecular formula of a compound composed of phosphorus and fluorine.
    Molar mass = 126 g/ mol
    Percent by mass P = 24.5%
    Percent by mass F = 75.5 % (PF_5)