無機化學 共 5 小題，每一小題 10 分。(2003.03.16)

(1)Give equations for reactions that could be used to separate Zn^{2+}, Cd^{2+}, and Hg^{2+} present in solution.

(2) From emf data predict the results of mixing Cl^- and BrO_3^- and 1M acid

E°_{acid} (V) 1.19 1.21 1.645 1.63 1.36

$ClO_4^- \rightarrow ClO_3^- \rightarrow HClO_2 \rightarrow HClO \rightarrow Cl_2 \rightarrow Cl^-$

E°_{acid} (V) 1.743 1.49 1.59 1.07

$BrO_4^- \rightarrow BrO_3^- \rightarrow HBrO \rightarrow Br_2(l) \rightarrow Br^-$

(3) Indiacte the order of increasing values of the proton affinity expected for the following species: NH_2^-, NH_3, NH^{2-}, C_5H_5N, and CH_3CN.

(4) Calculate the dipole moment to be expected for the ionic structure of H^+Cl^- using the same internuclear separation as for the HCl molecule. Also calculate the dipole moment for HCl assuming 19% ionic character. Express the dipole moments in Debye unit. The bond distance for HCl is 127.4 pm. An electron has $4.80*10^{-10}$ esu. One Debye unit is 10^{-8} pm-esu.

(5) Write the electron configuration beyond a noble gas core and give the number of unpaired electrons for Fe^{2+} and Fe^{3+}.(for example, F=(He) $2s^2$ $2p^5$)

(背面仍有題目,請繼續作答)

分析化學 共5小題，每一小題10分。(2003.03.16)

(6) A 25.00-mL sample containing Ca^{2+} was treated with sodium oxalate to precipitate CaC_2O_4, which was washed, dissolved in acid, and titrated with 14.08 mL of 0.0007265 M $KMnO_4$. Calculate the molarity of Ca^{2+} in the unknown.

(7) When the difference in pH across the membrane of a glass electrode at 25°C is 4.63 pH units, how much voltage is generated by the pH gradient?

(8) Calculate pCo^{2+} when 14.00 mL of 0.03855 M EDTA has been added to 25.00 mL of 0.02026 M Co^{2+} at pH 6.00. $K_{f,Co}=2.04*10^{16}$; $\alpha_{Y4-} = 2.3*10^{-5}$ at pH=6.

(9) A solution containing acetic acid, oxalic acid, ammonia, and pyridine has a pH of 9.00. What fraction of ammonia is not protonated? The pK_a for acetic acid, ammonium ion, and pyridine are 4.757, 9.244, 5.229, respectively. The pK_{a1} and pK_{a2} for oxalic acid are 1.252 and 4.226, respectively.

(10) Consider a saturated solution of $R_3NH^+Br^-$, where R is an organic group. Find the solubility (mol/L) of $R_3NH^+Br^-$ in a solution maintained at pH 9.50.

$$R_3NH^+Br^-(s) \leftrightarrow R_3NH^+ + Br^- \qquad K_{sp} = 4.0 * 10^{-8}$$

$$R_3NH^+ \leftrightarrow R_3N + H^+ \qquad K_a = 2.3 * 10^{-9}$$