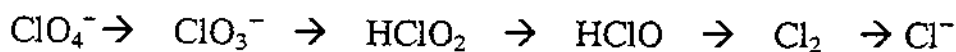


無機化學 共 5 小題，每一小題 10 分。(2003.03.16)

(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

$E^\circ_{\text{acid}}(\text{V})$ 1.19 1.21 1.645 1.63 1.36



$E^\circ_{\text{acid}}(\text{V})$ 1.743 1.49 1.59 1.07



(3) Indicate the order of increasing values of the proton affinity expected for the following species: NH_2^- , NH_3 , NH_2^+ , $\text{C}_5\text{H}_5\text{N}$, 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^{-18} 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, $\text{F} = (\text{He}) 2s^2 2p^5$)

(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. $K_{f,\text{Co}} = 2.04 \times 10^{16}$; $\alpha_{Y4-} = 2.3 \times 10^{-5}$ 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 $\text{R}_3\text{NH}^+\text{Br}^-$, where R is an organic group. Find the solubility (mol/L) of $\text{R}_3\text{NH}^+\text{Br}^-$ in a solution maintained at pH 9.50.

