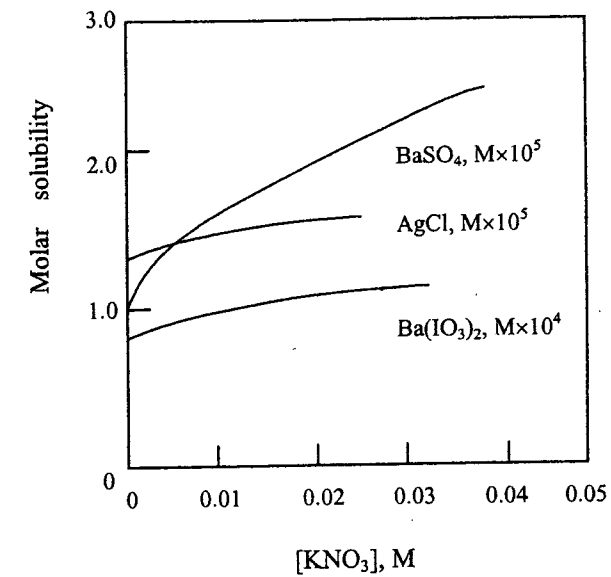


(5%) Referring to the following figure, please state the effect of the concentration of  $\text{KNO}_3$  on the molar solubility of  $\text{BaSO}_4$ ,  $\text{AgCl}$  and  $\text{Ba}(\text{IO}_3)_2$ .



(10%) (a) Calculate the hydroxide ion concentration in a 0.0100 M sodium hypochlorite solution. ( $K_a$  of  $\text{HOCl}$  is  $3.0 \times 10^{-8}$ )

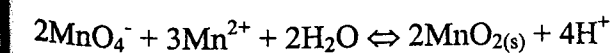
(b) Calculate the hydronium ion concentration in a  $2.0 \times 10^{-4}$  M aniline hydrochloride solution. ( $K_a$  of  $\text{C}_6\text{H}_5\text{NH}_3^+$  is  $2.51 \times 10^{-5}$ )

(10%) A 50.00 mL aliquot of 0.0500 M  $\text{NaCN}$  is titrated with 0.1000 M  $\text{HCl}$ . Calculate the pH after the addition of (a) 0.00, (b) 10.00, (c) 25.00, and (d) 26.00 mL of acid. ( $K_a$  of  $\text{HCN}$  is  $6.20 \times 10^{-10}$ )

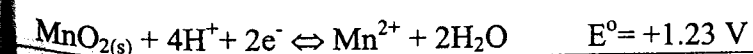
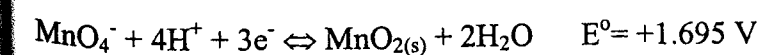
(10%) The arsenic in a 9.13-g sample of pesticide was converted to  $\text{AsO}_4^{3-}$  and precipitated as  $\text{Ag}_3\text{AsO}_4$  with 50.00 mL of 0.02105 M  $\text{AgNO}_3$ . The excess  $\text{Ag}^+$  was then titrated with 4.75 mL of 0.04321 M  $\text{KSCN}$ . Calculate the percentage of  $\text{As}_2\text{O}_3$  in the sample. (M.W. of  $\text{As}_2\text{O}_3 = 198.4 \text{ g mol}^{-1}$ )

(10%) Derive a curve (pCa as a function of volume of EDTA) for the titration of 50.0 mL of 0.00500 M  $\text{Ca}^{2+}$  with 0.0100 EDTA in a solution buffered to a constant pH of 10.0. ( $\alpha_4$  at pH 10 = 0.35,  $K_{\text{CaY}} = 5.0 \times 10^{10}$ )

(10%) Calculate the equilibrium constant for the reaction



Where



(10%) The cell

SCE || CdA<sub>2</sub> (sat'd), A<sup>-</sup> (0.00250M) || Cd

has a potential of -0.721 V. Calculate the solubility product of CdA<sub>2</sub>, neglecting the junction potential.

(potential of reference electrode = 0.244 V)

(10%) (a) How does the existence of a current affect the potential of an electrochemical cell?

(b) How do concentration polarization and kinetic polarization resemble one another? How do they differ?

(10%) What ion source is suitable for the analysis of heavy metals in aqueous sample when mass spectrometer is used as detector? Please state the reason why the ion source you chose is suitable.

(a) Electrospray ionization

(b) Chemical ionization

(c) Field ionization

(d) Matrix assisted laser desorption/ionization

(e) Inductively induced plasma

0. (7%) Describe the basic design difference among a spectrometer for absorption, emission and fluorescence measurements.

1. (8%) Describe the fundamental difference between ion-exchange and size-exclusion chromatography. Please list the typical application of aforementioned chromatographic techniques.