

I Differentiate the following terms in each pair in brief (5% each, 40% total).

- A) Activity vs. ionic strength
- B) Limit of detection vs. sensitivity
- C) Auxiliary complexing agent vs. masking agent
- D) Mobility vs. velocity
- E) Amperometry vs. voltammetry
- F) Isoelectric point vs. isosbestic point
- G) Resolution vs. efficiency
- H) Gradient vs. isocratic techniques in gas chromatography

II Compare the difference between capillary electrophoresis and high-performance liquid chromatography (10% total)

III Calculate the solubility values for  $\text{CaF}_2(\text{s})$  (A) in water and (B) in a buffer at pH 5.0, respectively. The  $K_{\text{sp}}$  for  $\text{CaF}_2(\text{s})$  is  $3.9 \times 10^{-11}$ ,  $K_{\text{a}}$  for  $\text{F}^-$  is  $1.5 \times 10^{-11}$ , and  $K_{\text{w}}$  for water is  $10^{-14}$ . (5% each, 10% total)

IV A 20.00-mL solution containing 0.1004 M KI was titrated with 0.0845 M  $\text{AgNO}_3$ . The potentials for the silver indicator cell and the reference cell are 0.799 and 0.241 V, respectively. (A) Calculate the  $K_{\text{sp}}$  for  $\text{AgI}$  if the cell voltage is 0.082V at the equivalence point. (B) If the 20-mL solution of 0.1004 M KI contains 0.100M KCl, is it possible to determine the equivalent points for chloride and iodide by potentiometric precipitation titration using 0.0845 M  $\text{AgNO}_3$ ? Why? (5% each, 10% total)

V What is the Beer's law? (3%) Plot the relationship between absorbance and concentration and explain the meaning of the slope. (3%) Name all possible instrumental and chemical errors causing the deviation of the plot (14%). (20% total)

VI The formation constant for  $\text{FeY}^-$  is  $1.3 \times 10^{25}$ . Calculate the concentrations of free  $\text{Fe}^{3+}$  (A) at the equivalence point and (B) at the addition of 60.0 mL of EDTA when titrating 50.0 mL of 0.05 M  $\text{Fe}^{3+}$  (buffered to pH 10.0) with 0.05 M EDTA. (The fraction of EDTA in the form  $\text{Y}^{4-}$  is 0.36 at pH 10.0) (5% each, 10% total)