八十六學年度 化學工程學系 系(所) 乙 組碩士班研究生入學考試

科目 分析化學 科號 1703 共 2 頁第 1 頁 *請在試卷【答案卷】內作答

1. Two 25.00-mL aliquots of an old sulfamic acid solution were titrated with 0.1000 M NaOH. When phenolphthalein was used as the indicator, 22.00 mL is required to reach the end point. When methyl red was used, 21.50 mL was required. Calculate the percent of sulfamic acid that hydrolyzed. (10%)

2. The pH of a solution that is 0.200 M CH_3CO_2H and 0.200 M $NaCH_3CO_2$ is 4.76. What is the pH of a solution that is 0.0500 M CH_3CO_2H and 0.0500 M $NaCH_3CO_2$? [The atomic weight: Na 23] (10%)

3. A phosphorus iodide compound contains 10.86% phosphorus and 89.14% iodine. If 0.385 g of the substance is dissolved in 5.025 g of the solvent carbon disulfide, CS_2, the boiling point increases by 0.322°C. The boiling point constant for CS_2 is 2.34 °C/m. What is the molecular formula of the phosphorus iodide? [The atomic weight: P 30.9738, I 126.905, freezing-point constant 2.34 °C/mol/Kg] (10%)

4. A compound of vanadium contains 29.40% V, 61.37% Cl, and 9.23% O by mass. If 2.21135 g of this compound is reacted with excess $AgNO_3$, 5.48593 g AgCl is formed. The vanadium product contains 56.02% V and 43.98% O by mass.
   (a) Write formulas for the vanadium compounds.
   (b) What are the names of the silver compounds?
   (c) What are the oxidation numbers of the elements in the four compounds?
   (d) Write a balanced equation for the reaction bertween the vanadium compound and $AgNO_3$.
   (e) Use this information to calculate the atomic weight of vanadium.

   [The atomic weight: V 50.94, Cl 35.453, O 15.9994] (20%)

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5. Compare the instrumental difference between a flame atomic absorption spectrometer and a flame emission spectrometer and the effects on their analytical applications. (15%)

6. Describe the gas amplification for various types of gas-filled detector when subjected to X-ray irradiation, i.e., under different applied potentials. (15%)

7. Briefly describe the procedures to select a column for gas chromatographic analysis. (10%)

8. Design an analytical method to determine carbon black in polyethylene without using any wet chemical method. (10%)