

國立臺北科技大學九十八學年度碩士班招生考試

系所組別：3711 有機高分子研究所甲組

第二節 分析化學 (選考) 試題

第一頁 共一頁

注意事項：

1. 本試題共 9 題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. Determine Ag^+ molar concentration after 30.00mL of 0.1000M silver nitrate have been added to 50.00mL of a solution that is 0.0500M in iodide ion and 0.0800M in chloride ion. ($K_{sp}(\text{AgI})=8.3 \times 10^{-17}$, $K_{sp}(\text{AgCl})=1.82 \times 10^{-10}$) (10 points)
2. A method for the analysis of DDT gave the following results when applied to pesticide-free foliage samples: $\mu\text{g DDT} = 0.2, -0.5, -0.2, 1.0, 0.8, -0.6, 0.4, 1.2$. Calculate the standard deviation and the DDT detection limit (at the 99% confidence level) of the method for a sample analysis. ($t=3.50$ at 7 degrees of freedom and 99% confidence level) (10 points)
3. Calculate the equilibrium constant for the reaction (10 points)
$$2\text{Fe}^{3+} + 3\text{I}^- \rightleftharpoons 2\text{Fe}^{2+} + \text{I}_3^-$$
and we find $2\text{Fe}^{3+} + 2\text{e}^- \rightleftharpoons 2\text{Fe}^{2+}$ $E^0 = +0.771\text{V}$
 $\text{I}_3^- + 2\text{e}^- \rightleftharpoons 3\text{I}^-$ $E^0 = +0.536\text{V}$
4. A monochromator had a focal length of 1.6m and a collimating mirror with a diameter of 2.0cm. The dispersing device was a grating with 1250 lines/mm. For first-order diffraction,
 - (a) what was the resolving power of the monochromator if a collimated beam illuminated 2.0cm of the grating? (5 points)
 - (b) what is the first-order reciprocal linear dispersion of the monochromator described above? (5 points) (10 points total)

5. Define: (20 points total)
 - (a) electroosmotic flow (5 points)
 - (b) longitudinal diffusion (5 points)
 - (c) accuracy and precision (5 points)
 - (d) electric double layer (5 points)
6. Why are ionization interferences less severe in inductively coupled plasma source than in flame emission spectroscopy? (5 points)
7. Gaseous HCl exhibits an infrared peak at 2890cm^{-1} due to the hydrogen/chlorine stretching vibration.
 - (a) Calculate the force constant for the bond. (8 points)
 - (b) Calculate the wavenumber of the absorption peak for DCl assuming the force constant is the same as that calculated in part (a) (7 points)
($H=1, D=2, Cl=35.5, c=3.00 \times 10^{10}\text{cm s}^{-1}$) (15 points total)
8. Calculate the ratios of $(M+2)^+$ to M^+ peak heights and $(M+4)^+$ to M^+ peak heights for $\text{C}_2\text{H}_4\text{ClBr}$.
(isotope abundance: ^{13}C negligible, ^{35}Cl 100%, ^{37}Cl 32.5%, ^{79}Br 100%, ^{81}Br 98%) (10 points)
9. The following 300MHz proton spectrum is for an ester compound having an empirical formula $\text{C}_{10}\text{H}_{14}\text{O}_2$. Deduce the structure and assign all ^1H signals. (m: multiplet, t: triplet, sext: sextet) (10 points)

