

國立臺北科技大學九十六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. The inside diameter of an open cylindrical tank was measured. The results of four replicate measurements were 5.4, 5.2, 5.5, and 5.2m. Measurement of the height of the tank yielded 9.8, 9.2 and 9.6m. Calculate the volume in liters of the tank and the standard deviation of the result. (15 points)
2. Calculate the hydroxide ion concentration in a 0.0100M sodium hypochloride solution. $K_a(\text{HOCl})=3.8 \times 10^{-8}$, $K_w=1.00 \times 10^{-14}$. (10 points)
3. Substances A and B have retention times of 16.40 and 17.63 min, respectively, and on a 30.0-cm column. An unretained species passes through the column in 1.30min. The peak widths (at base) for A and B are 1.11 and 1.21min, respectively. Calculate (a) column resolution (b) average number of plates in the column. (10 points)
4. The acid/base indicator HIn undergoes the following reaction in dilute aqueous solution:



The following absorbance data were obtained for a 5.00×10^{-4} M solution of HIn in 0.1M NaOH and 0.1M HCl. Measurements were made at a wavelength of 485nm and 625nm with 1.00-cm cells

$$0.1\text{M NaOH} \quad A_{485}=0.052 \quad A_{625}=0.823$$

$$0.1\text{M HCl} \quad A_{485}=0.454 \quad A_{625}=0.176$$

In the NaOH solution, essentially all of the indicator is present as In^- ; in the acidic solution, it is essentially all in the form of HIn.

- (a) Calculate molar absorptivities for In^- and HIn at 485 and 625nm. (5 points)
 - (b) Calculate the acid dissociation constant for the indicator if a pH5.00 buffer containing a small amount of the indicator exhibits an absorbance of 0.472 at 485nm and 0.352 at 625nm (1.00-cm cells). (10 points)
5. Why does the glass transition for a polymer yield no exothermic or endothermic peak in differential thermogram? (10 points)
 6. What is the difference between longitudinal and transverse relaxation in nuclear magnetic resonance spectroscopy? (10 points)
 7. What are the advantages of a Fourier transform infrared spectrometer compared with a dispersive instrument? (10 points)
 8. An XPS electron was found to have a kinetic energy of 1073.5eV when a $\text{MgK}\alpha$ source was employed ($\lambda=9.8900\text{\AA}$). The electron spectrometer has a work function of 1.47eV.
 - (a) Calculate the binding energy for the emitted electron in eV.
 - (b) If the ejected electron with the $\text{MgK}\alpha$ source had been an Auger electron, what would its kinetic energy be with the Al $\text{K}\alpha$ ($\lambda=8.3393\text{\AA}$) source? ($h=6.625 \times 10^{-34}\text{J}\cdot\text{s}$, $c=3.00 \times 10^{10}\text{cm/s}$, $1\text{J}=6.24 \times 10^{18}\text{eV}$) (10 points)
 9. Describe gaseous field ionization and desorption field ionization sources in mass spectrometry. (10 points)