

1. 有一種化合物, 分子量為 214.3 g, <sup>0.1235g</sup> 溶解在甲醇中配成 1.00L 的溶液. 該溶液在 235 nm 時, 在 1.00 cm 的試樣槽中測出的吸光度為 0.824. 試求此化合物之莫耳吸收係數 (molar absorptivity  $\epsilon$ )
2. 試繪圖解釋 IR 光譜所用之偵測器 bolometer (or thermister)
3. 試述完全解偶氫之碳光譜應如何測量? 使用這種技術有何優美?
4. 試解釋螢光 (fluorescence) 及磷光 (phosphorescence) 產生之原因及差異.
5. 解釋下列名詞  
  - 1) Raman
  - 2) Rayleigh
  - 3) Tyndall
  - 4) Stokes
  - 5) anti-stokes
6. 那三種主要干擾, 會在原子吸收光譜產生. 如何將之消除?
7. 在 25°C 時, 相對於飽和甘汞電極 (saturation calomel electrode), 用 0.01 M  $\text{Fe}^{2+}$  溶液滴定 0.01 M  $\text{Cr}_2\text{O}_7^{2-}$  pH 為 3.50 的緩衝溶液中的滴定終點的電位.  
 已知  $\text{Fe}^{3+}/\text{Fe}^{2+}$   $E^\circ = 0.771 \text{ V}$   
 $\text{Cr}_2\text{O}_7^{2-}$   $E^\circ = 1.33 \text{ V}$
8. Mn 的水溶液試樣 10 mL 加入 5 個 50.0 mL 的容量瓶中. 含有 10 ppm 的 Mn 的溶液, 也用不同的體積 0.0, 10.0, 20.0, 30.0 及 40.0 mL 加入此五瓶中, 並稀釋至 50.0 mL. 結果如下.

unknown mL	Standard mL	Absorbance
10	0.0	0.201
10	10.0	0.292
10	20.0	0.378
10	30.0	0.467
10	40.0	0.554

- (a) 請繪圖
- (b) 試算該樣品中有多少 ppm Mn

PART 2

1. A newly made capillary column for gas chromatography was first tested for its coating efficiency and then slowly washed with 10 ml solvent. Finally this column was retested at the same condition. The following results were obtained

	$t_m$	$t_r$
before washing	45 seconds	369 seconds
after washing	45	288

a) If the original unwashed column had a  $0.25 \mu\text{m}$  film thickness of stationary phase, what is the final film thickness after washing? (5%)

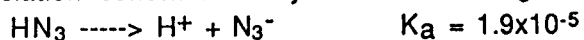
b) If this column has a 10 m length and  $200 \mu\text{m}$  inner diameter, what are the total theoretic plates for that testing compound in that condition? (The diffusion coefficients for that solute in mobile phase and stationary phase under that condition are 0.1 and  $1 \times 10^{-5} \text{ cm}^2/\text{s}$  respectively) (5%)

c) If a pair of solutes were eluted with a selective factor of 1.04 and a resolution of 1.4. What is the average velocity for the second compound? (8%)

2. A Flame Ionization Detector (FID) has a minimum detectable current of  $1.5 \times 10^{-13}$  amp at the most sensitive condition. The efficiency of ion production and collection is  $10^{-6}$  for carbon which were introduced into the detector. If the minimum detection amount is at least 10 times of this minimum value for a eluted chromatographic peak, calculate the detection limits for a) a peak eluted from a packed column with 10 seconds chromatographic zone b) a peak eluted from a capillary column with only 3 seconds (8%)

3. The FID described above has linear range of  $10^5$ . Calculate the minimum concentration factor necessary for analysis a sample containing 1 ppb of n-dodacane if we want the analysis be done in the middle concentration of this range by a capillary column. (The maximum allowable injection volume is  $1 \mu\text{m}$  for splitless injection) (8%)

4. The solubility of silver azide,  $\text{AgN}_3$ , in water is  $5.4 \times 10^{-5}$  M. The dissociation constant for hydrazoic acid is given by



If excess solid  $\text{AgN}_3$  is added to a liter of 2F nitric acid, what would be the final equilibrium concentration of  $\text{Ag}^+$ ?

5. A series RC circuit is used as a filter to pass through a high frequency information from a source with a regular 60 Hz line-frequency. a) draw a simple RC circuit which can pass this information but filter out the line-frequency b) calculate the capacitor C value if  $R = 1 \text{ m}\Omega$  at the half-power frequency ( $E_{\text{out}} = 0.5 \times E_{\text{in}}$ )

Equations : 1.  $N=L/H$  2.  $K=\beta k'$  ( $\beta=r/2df$ )

3.  $R=(N^{1/2}/4)(1-1/\alpha)(k_2'/1+k_2')$  4.  $\bar{v}_R=L/t_R$  5.  $\bar{v}_m=L/t_m$

6.  $H=2D_m/\bar{v}+[(1+6k'+11k'^2)/24(1+k')^2] [r^2\bar{v}/D_m]+2k'd_f^2v/3(1+k')^2D_L$

7.  $1 \text{ amp}=1 \text{ Coulomb/second}$  8. one electron carry  $1.6 \times 10^{-19}$  coulomb

9.  $\chi_c=1/2\pi fC$ , for RC in series  $Z=(\chi_c^2 + R^2)^{1/2}$ , and  $E=IZ$