國立嘉義大學 100 學年度
應用化學系碩士班(甲組)招生考試試題

科目：綜合化學(II)

一、分析化學試題 (共 50 分) (需要使用計算機)

1. (A) Detection limit is a statistical concept. Give the statistical meaning of detection limit. (3 分)

   (B) For determining the detection limit of an analyte by a spectrophotometric method, a low-concentration analyte solution was prepared, and nine replicate measurements gave average absorbance (and standard deviation) of 0.0058 (± 0.0008). The slope of a calibration curve (abs versus conc.) of the analyte was m = $3.56 \times 10^4 \, M^{-1}$. Find the concentration detection limit of the analyte. (3 分)

2. You developed a new method for determination of calcium in serum. When analyzing a serum sample by a certified method, the calcium concentration (and standard deviation) obtained from six replicate measurements was 0.335 (±0.004) mM. Six replicate measurements of the same sample by your method gave concentration of 0.322 (±0.005) mM. Do the data indicate the presence of systematic errors in your method at the 95% confidence level? (The student's t values for degree of freedom 10, 11, and 12 are 2.228, 2.200, and 2.180, respectively.)   (6 分)

3. The pK_a values of a diprotic acid H_2A are $pK_{a1} = 3.76$, $pK_{a2} = 7.48$.
   (A) What is the major component individually at pH 3 and pH 6? Indicate the way you get the answers. (3 分)
   (B) Calculate the pH of 0.200 M H_2A + 0.500 M NaHA. (3 分)

4. Indicate and explain the effect of the following additives on solubility of CaC_2O_4 in water.
   (A) 0.1 M KNO_3 (B) 0.1 M HNO_3. (6 分)

5. Differentiate standard addition method and internal standard method. (6 分)

6. Explain for the different situations: Pt-gauze working electrode is used in coulometry and Pt-microelectrode is used in voltammetry. (4 分)

7. Compare the elution or migration order of various sized proteins in (A) molecular exclusion chromatography (B) gel electrophoresis (SDS-PAGE), and give the reasons. (4 分)

8. Explain (A) the term "sensitivity". (B) high sensitivity of fluorescence detection. (C) high sensitivity of stripping voltammetry. (9 分)

9. Substances A and B have retention times of 6.38 and 7.75 min, respectively, in a liquid chromatogram. The peak widths (at base) for A and B are 0.65 and 0.78 min, respectively. Calculate the resolution. (3 分)

二、物理化學試題(共 50 分)

　　說明：1. 答案必須要寫在答卷上，寫在試卷上不予計分。
　　　　　2. 請標明題號並依序作答。

問答題

1. (A) Draw all the normal modes of CO_2 (B) Point out which of them are IR active or Raman active. (C) Explain why CO_2 does not have the microwave spectrum (pure rotational spectrum)   (D) Does CO_2 have the pure rotational Raman spectrum? (12 分)

2. Describe briefly (A) the zeroth law (B) the first law (C) the second law and (D) the third law of thermodynamic. (8 分)

3. An isotopic substitution can greatly modify the reaction rate when the isotopic replacement is in a chemical bond. (A) Which one of the following molecule has the fast reaction rate? (a) CH_3OH (b) CH_3OD (c) CD_3OH (d) CD_3OD (B) Please explain your answer. (6 分)

4. Explain the following terms briefly. (24 分)
   (A) Anharmonicity of molecular vibration
   (B) Sodium D-line
   (C) Nuclear chain reactions
   (D) orthogonal states in quantum mechanics
   (E) transition dipole moment
   (F) dynamic dipole moment