編號： 292

國立成功大學 109 學年度碩士班招生考試試題

系　　所：環境醫學研究所

考試科目：化學儀器分析

考試日期：0211，節次：3

※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Explain why molecular absorption spectra are band spectra, in contrast to that atomic absorption spectra are line spectra. (5%)

2. Provide reasonable explanations to the fact that laser-induced fluorescence detectors, as detectors for liquid chromatography, are often able to yield much lower detection limits than those operated using UV-VIS absorption. (5%)

3. Describe the working principles and applications of EI, CI, and NICI? Point out the similarity, advantage, or disadvantage, if any, among them. (6%)

4. Describe how standard addition method can be applied to measure the concentration of mono-(2-ethyl-5-carboxypentyl) phthalate in human urinary matrix and the advantages provided by the method. (10%)

5. What are the three most common types of optical spectrometers? List the names of the three types of instruments, then draw three block diagrams to illustrate the components of these instruments for optical spectroscopy. Use the diagrams to explain how these instruments work and point out the major differences among them. (10%)

6. What is the range of wavelength in nanometer (nm) for visible light? Convert the range into the corresponding wave numbers per cm (cm^{-1}) and frequencies (Hz) of the electromagnetic wave. Calculate the photon flux (number of photons/second) required to be detectable by an optical spectrometer that is equipped with a photomultiplier with a gain of 10^7 and a pico-Amp current meter. (10%)

7. Describe the working principle and applications of ESI? What is the difference between ESI and nanoESI? What are the advantages of nanoESI over ESI? (12%)

8. Describe the working principles and applications of FT-ICR, ion trap, and Orbitrap? Point out the similarity, advantage, or disadvantage, if any, among them. (12%)

9. Describe how the six numerical criteria of an HRGC-HRMS (high resolution gas chromatography-high resolution mass spectrometry) method for measuring trace dioxin levels in human blood samples can be assessed. List appropriate terms first, and then explain what they mean and how they can be calculated. (15%)

10. Construct two hypothetical van Deemter plots and write down the related equations for gas and liquid chromatographic columns. Is there any significant difference between these two plots? Why? Explain the meanings of A, B, and C terms. Then use the equations to explain how and why the particle size in a packed HPLC column affects the column efficiency and the pressure required for pumping mobile phase through the column. (15%)