國立成功大學

111學年度碩士班招生考試試題

編　號：287

系　所：環境醫學研究所

科　目：化學儀器分析

日　期：0220

節　次：第 3 節

備　註：不可使用計算機

※ 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. How is chromatographic resolution calculated? How is mass spectrometric resolution calculated? Discuss why different procedures are used to calculate chromatographic and mass spectrometric resolutions. Also list the advantages and disadvantages of these two procedures. (10%)

2. Describe how the six numerical criteria of an ICPOES (inductively coupled plasma optical emission spectroscopy) method for measuring arsenic 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%)

3. 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 why laser-induced fluorescence detectors for liquid chromatography are often able to yield much lower detection limits than those operated using UV-VIS absorption. (15%)

4. Describe the working principle and applications of EI, CI, NICI, and ESI? Point out the similarity, advantage, or disadvantage, if any, among them. (15%)

5. Describe the working principles and applications of quadrupole, ion trap, FT-ICR and Orbitrap? Point out the similarity, advantage, or disadvantage, if any, among them. (15%)

6. 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%)

7. Describe how the confidence limit (uncertainty) of a measurement can be assessed and reported. Then write down an equation that describes how the measurement uncertainties of three measurements, p, q, and r, propagate into the uncertainty of x, where $x = f(p, q, r)$ and the standard deviations of p, q, and r, are expressed as s_p, s_q, and s_r. If $x = p \cdot q/ r$, what would the equation be? (15%)