

國立成功大學

113學年度碩士班招生考試試題

編 號： 276

系 所： 環境醫學研究所

科 目： 化學儀器分析

日 期： 0202

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. Describe how the six numerical criteria, precision, bias, sensitivity, detection limit, dynamic range, and selectivity, of an ICPOES (inductively coupled plasma optical emission spectroscopy) method for measuring arsenic levels in human blood samples can be assessed. Provide the meanings of these six numerical criteria first and then show how they can be calculated. (20%)
2. Draw an energy diagram to describe how the absorption, fluorescence, and chemiluminescence processes occur. Then draw block diagrams to illustrate the components of the following three types of instruments for optical spectroscopy: absorption, fluorescence, and chemiluminescence spectrometers. Use the diagrams to explain the operation principles of each components and point out the major differences among the three types of spectrometers. (20%)
3. Construct a hypothetical van Deemter plot and the related equation for a packed liquid chromatographic column. Explain the meanings of A, B, and C terms as well as their individual and overall effects. Then use the equation 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%)
4. What are effects of poor vacuum conditions to the operations of mass spectrometers? Describe the working principles of the three commonly used high vacuum pumps, diffusion, turbo-molecular, and cryogenic pumps, for mass spectrometers. (15%)
5. Describe the working principles and applications of the following terms related to the mass spectrometry. (20%)
(A) ESI and MALDI
(B) Quadrupole and Orbitrap
6. 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? (10%)