國立成功大學

110學年度碩士班招生考試試題

編　號：295

系　所：環境醫學研究所

科　目：化學儀器分析

日　期：0203

節　次：第 3 節

備　註：不可使用計算機

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※ 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 of an HRGC-HRMS 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%)
2. What are the analytical advantages and disadvantages provided by ion fragmentation in an EI source? (5%)
3. 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%)
4. Describe the working principle of discrete dynode and continuous dynode that are commonly used in electron multipliers for optical and/or mass spectrometry? List the similarity and major differences between them? (5%)
5. Describe how the confidence limit (uncertainty) of a measurement can be assessed and reported. Write down a general equation that describes how the measurement uncertainty of three measurements, p, q, and r, propagate into the uncertainty of x (that is, σ_x), where $x = f(p, q, r)$, then give specific equations for calculating σ_x, where (i) $x = (p + q + r)$ and (ii) $x = (p \times q / r)$ (10%)
6. Draw an energy diagram to describe how the fluorescence and chemiluminescence processes occur. Then draw two block diagrams to illustrate the components of fluorescence and chemiluminescence spectrometers and explain how these two instruments work. (10%)
7. Describe the working principles and applications of ICPOES and ICPMS? Write the full names of these two analytical methods, then point out the similarity, advantage, or disadvantage, if any, between them. (10%)
8. Describe the working principle and applications of ESI and MALDI? List the similarity and major differences between them? (10%)
9. 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. (10%)
10. Describe the definition/working principle and applications of the following two related term/devices. Then point out the similarity and/or difference, if any, between these two terms. (20%)
    (A) SDS-PAGE and IEF
    (B) TOF and quadrupole mass spectrometers
    (C) Detectors used in chromatography: ECD in GC and ECD in LC
    (D) The definitions of signal resolution in chromatography and mass spectrometry