

編號： 476 系所：環境醫學研究所乙組

科目：化學儀器分析

本試題是否可以使用計算機：可使用，不可使用（請命題老師勾選）

1. Describe (list appropriate terms first, then explain what they mean and how they can be calculated) the six numerical criteria for selecting analytical methods. (20%)
2. Describe the working principles and applications in chemical instrumentation of the following techniques or devices. If the terms are acronyms, give their full names (in English). (30%)
 - (1) Photomultiplier tube
 - (2) NICI
 - (3) ESI
 - (4) TOF
 - (5) MCP
 - (6) ECD
3. Draw: (15%)
 - (1) A hypothetical van Deemter plot for a gas chromatographic column. Explain the meanings of A, B, and C terms.
 - (2) The chemical structures for the stationary phases that are commonly used in the following HPLC columns. (i) C18 (ii) SCX
 - (3) An energy diagram to describe how the fluorescence and phosphorescence processes occur. Then draw two block diagrams to illustrate the components of fluorescence and phosphorescence spectrometers and explain how these two instruments work.
4. Briefly answer the following questions: (35%)
 - (1) What are the characteristics of an ideal detector for a GC instrument?
 - (2) What are the analytical advantages provided by ion fragmentation in an EI source?
 - (3) What are effects of poor vacuum conditions to the operations of mass spectrometers?
 - (4) How the standard addition method can be applied to measure the concentration of a benzene metabolite in urinary matrix?
 - (5) Why the particle size in a packed HPLC column affects the column efficiency and the pressure required for pumping mobile phase through the column?
 - (6) Calculate the resolution required to resolve the mass spectral peaks for $^{116}\text{Sn}^+$ and $^{232}\text{Th}^{2+}$. Atomic weights: Sn (115.90219 Da) and Th (232.03800 Da).
 - (7) What is the operation principle of a diffusion pump? Why is it necessary a diffusion pump be used in conjunction with a fore rough pump to achieve high vacuum?