

※ 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. Draw a diagram showing components of a mass spectrometer system and describe the functions of these components. (10%)
2. Describe (list appropriate terms first, then explain what they mean and how they can be calculated) the six numerical criteria for selecting analytical methods. (10%)
3. 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  $x = f(p, q, r)$ . (10%)
4. 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 how these instruments work and the major differences among them. (10%)
5. 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. 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. (10%)
6. 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. (50%)
  - (A) LOD and LOQ
  - (B) Grating and prism
  - (C) SDS-PAGE and IEF
  - (D) Internal standard and standard addition
  - (E) Phosphorescence and chemiluminescence
  - (F) Calibration sensitivity and analytical sensitivity
  - (G) Temperature gradient in GC and solvent gradient in LC
  - (H) Partition chromatography and adsorption chromatography
  - (I) Selectivity factor and resolution in chromatographic science
  - (J) Detectors used in chromatography: ECD in GC and ECD in LC