

※ 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 precision, bias, sensitivity, detection limit, dynamic range, and selectivity of an HRGC-HRMS (high resolution gas chromatography-high resolution mass spectrometry) method for measuring trace dioxin levels in human blood samples can be assessed. (15%)
2. Describe how standard addition method can be applied to measure the concentration of Mono-(2-ethyl-5-carboxypentyl) phthalate in human urinary matrix and the advantages provided by the method. (10%)
3. Explain why molecular absorption spectra are band spectra, in contrast to that atomic absorption spectra are line spectra. (10%)
4. Draw an energy diagram to describe how the chemiluminescence and phosphorescence processes occur. Then draw two block diagrams to illustrate the components of chemiluminescence and phosphorescence spectrometers and explain how these two instruments work and differ. (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. (15%)
6. What are effects of poor vacuum conditions to the operations of mass spectrometers? Describe the working principles of the two commonly used high vacuum pumps, diffusion and turbo-molecular pumps, for mass spectrometers. (10%)
7. 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. (30%)
 - (A) ESI and MALDI
 - (B) APPI and APCI
 - (C) Orbitrap and FT-ICR mass spectrometers
 - (D) Partition chromatography and adsorption chromatography
 - (E) Detectors used in chromatography: ECD in GC and ECD in LC
 - (F) Resolution in mass spectrometry and resolution in chromatographic science