

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 how standard addition method can be applied to measure the concentration of a benzene metabolite in urinary matrix. (10%)
2. Describe how the detection limit of an ICPOES (inductively coupled plasma optical emission spectroscopy) method for measuring trace arsenic levels in drinking water can be assessed. (10%)
3. 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. (8%)
4. Draw block diagrams to illustrate the components of the following three types of instruments for optical spectroscopy. Use the diagrams to explain how these instruments work and the major differences among them. (12%)
 - (a) Absorption spectrometer.
 - (b) Fluorescence spectrometers.
 - (c) Chemiluminescence.
5. Describe applications and working principles of the following devices. (24%)
 - (a) Flame ionization detector
 - (b) Photomultiplier tube
 - (c) Electrospray ionization source
 - (d) Quadrupole/time-of-flight hybrid mass analyzer
6. Calculate: (12%)
 - (a) The cyclotron frequency of a circulating Na^+ after the ion enters a 2.0-Tesla magnetic field with a velocity of 3000 m/s.
 - (b) 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. Answer the following questions: (24%)
 - (a) Why bromine atom-containing ions can be easily identified in a mass spectrum?
 - (b) What are the factors that determine the overall sensitivity of a mass spectrometer?
 - (c) Why are vacuum systems necessary for operations of mass spectrometers?
 - (d) Why quantitative analysis of dioxin-like compounds at ppt levels in human blood samples requires an expensive high-resolution gas chromatography-mass spectrometer?