

※選擇題請在答案卡內作答，非選擇題請在答案卷內作答

Entrance examination – analytical chemistry (part I)

- 第一部份(1-10 題)為選擇題：單選題；每題 5 分。
- 請選擇最正確的答案(只有一個正確答案)。若複選或未作答，此題以 0 分計。
- 選擇題請務必作答於答案卡(電腦讀卡)，否則將不予計分!

1. Which variable obtained during chemical analysis has no units (by definition)?
 - A) potential of an electrode
 - B) power of light
 - C) mass of a sample
 - D) absorbance of a sample
 - E) molarity of a compound
2. A sample of a boron compound was inserted to the flame of Bunsen burner. What color of the flame most likely indicates the presence of boron in the sample?
 - A) violet
 - B) blue
 - C) pink
 - D) green
 - E) red
3. You have 600 mL of 0.01 mM stock solution of pesticide standard dissolved in ethanol. Using this stock solution and water as diluent, what is the best way to prepare a 5 mL aliquot of 5 μ M solution of the standard?
 - A) Take 2500 μ L of the stock solution and add exactly 2500 μ L of water.
 - B) Take 2500 μ L of water and add exactly 2500 μ L of the stock solution.
 - C) Take 2500 μ L of the stock solution and add water to the final volume of exactly 5 mL.
 - D) Take 0.05 mL of the stock solution and add exactly 0.495 mL of water.
 - E) Take 0.5 mL of the stock solution and add water to the final volume of exactly 5 mL.
4. Which of the following methods/devices can easily be used to distinguish so-called *reducing sugars* from *non-reducing sugars*?
 - A) UV spectroscopy
 - B) Kjeldahl's method
 - C) Geiger-Müller counter

注意：背面有試題

參考用

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- D) immunochemistry
E) Fehling's test
5. Why optical microscopes using visible light are not normally used to observe metal nanoparticles?
A) because of high cost
B) because of the so-called *diffraction limit*
C) because the analysis takes more time than using electron microscopes
D) because metal nanoparticles are transparent to photons
E) because visible light normally causes *ablation* of nanoparticles
6. According to the Van Deemter plot for liquid chromatography, theoretical plate height:
A) is always proportional to linear velocity of mobile phase
B) is always inversely proportional to linear velocity of mobile phase
C) directly depends on the polarities of the separated molecules
D) is influenced by *longitudinal diffusion* of the separated molecules as well as other processes
E) is never influenced by *eddy diffusion*
7. Which of the following analytical techniques relies on detection of ions in the gas phase?
A) transmission electron microscopy
B) mass spectrometry
C) cyclic voltammetry
D) Raman spectroscopy
E) fluorimetry
8. Which process has to occur on the dynodes of photomultiplier tube so that the intensity of a photon beam impinging on the photocathode can be measured?
A) emission of secondary electrons
B) emission of photons
C) emission of protons
D) emission of neutrons
E) recombination of positrons and electrons
9. Which of the following is the critical component of the electrospray ion source for mass spectrometry?
A) photoresist
B) plasma generator
C) signal amplifier

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類組：化學類 科目：分析化學(1005)

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- D) high voltage power supply
E) laser
10. You have received a sample containing from 0.005 to 0.050 M of phenylalanine (in water) for analysis. Which technique is definitely not suitable for analysis of this sample?
- A) potentiometry with phenylalanine-ion-selective electrode
B) inductively coupled plasma mass spectrometry
C) ion chromatography coupled with UV absorption detection
D) electrospray ionization mass spectrometry
E) capillary electrophoresis with UV absorption detection

Entrance examination – analytical chemistry (part II)

- 以下第二部分為問答題(每題 10 分)
 - 計算題應詳列計算過程，無計算過程者不給分。
1. A 5×10^{-4} M solution of compound A exhibited an absorbance of 0.624 at 260 nm in a 1.000 cm cuvet. A blank had an absorbance of 0.029. The absorbance of an unknown solution of compound A was 0.386. Find the concentration of A in the unknown.
2. The terms “sensitivity” and “detection limit” are often used interchangeably, but actually have very different meanings. Explain the difference between these two terms.

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3. The most common detector used in FT-IR is the so-called TGS (Triglycine Sulfate) detector which is a thermal detector and has poor sensitivity. Explain why a photoemissive detector (like the photomultiplier tube commonly used in UV/Vis spectrometry) cannot be used in FT-IR.
4. Explain the difference between a fluorescence *emission spectrum* and a fluorescence *excitation spectrum*. Which more closely resembles an *absorption spectrum*?
5. Please illustrate how the van Deemter curve for HPLC differs when using 10 μm particles and 3 μm particles for column packing. Explain why these curves are different.

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