

系所組別： 化學系

考試科目： 分析化學

考試日期：0307，節次：4

※ 考生請注意：本試題 可 不可 使用計算機

## 一、 選擇題：(80%；每題 4 分)

1. An indicator HIn has  $K_a = 1 \times 10^{-8}$ . At pH = 6.0, what is the ratio HIn/In? (a) 1/100 (b) 100/1 (c) 1/10 (d) 10/1
2. Which of the following noise is frequency dependent? (a) thermal noise (b) flicker (c) shot (d) chemical.
3. Which statement is true? (a) high-pass filters are used to remove low frequency flicker noise (b) high-pass filters are used for remove high frequency noise (c) low-pass filters are used to remove low frequency flicker noise (d) low-pass filters are used to remove low frequency thermal noise.
4. What is the reflection loss when a beam of radiant passes through an empty quartz plate having a refraction index of 1.55? (a) 4.65% (b) 9.1% (c) 9.3% (d) 17.3%
5. The suitable radiation source for an ultraviolet-visible spectrophotometer is: (a) Ar lamp (b) tungsten lamp (c) nichrome wire (d) Xe lamp.
6. A photomultiplier tube can be used as the detector for (a) ultraviolet-visible (b) infrared (c) ultraviolet-visible-infrared (d) visible-infrared.
7. For a spectrophotometer, the monochromator slit is important for the spectrum quality, which of the following statements is correct: (a) decreasing the slit width decreases the resolution (b) decreasing the slit width decreases the available radiant power (c) wider slit width is better for quantitative analysis (d) wider slit width is better for qualitative analysis.
8. Temperature fluctuations exert a profound effect upon the atomic spectrometry. Which of the following is true? (a) absorption methods are more temperature dependent than emission methods (b) emission methods are not temperature dependent (c) fluorescence methods are less temperature dependent than emission methods (d) an increase in temperature enhances the line broadening due to Boltzmann effect.
9. In atomic absorption spectroscopy, the addition of a small volume of low molecular organic solvents to the analyte solution may (a) reduce the nebulizer efficiency (b) increase flame temperature (c) increase the sensitivity (d) reduce the chemical interferences.

(背面仍有題目，請繼續作答)

系所組別： 化學系

考試科目： 分析化學

考試日期： 0307，節次： 4

※ 考生請注意：本試題 可 不可 使用計算機

10. Which of the following chromophores has an absorption band at a longest wavelength? (a)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}=\text{CH}_2$  (b)  $\text{CH}=\text{CHCH}_2\text{CH}_2\text{CH}=\text{CH}_2$   
(c)  $\text{H}_2\text{C}=\text{CHCH}=\text{CH}_2$  (d)  $\text{H}_2\text{C}=\text{CHCH}=\text{CHCH}=\text{CH}_2$ .
11. For luminescence spectrometry, which of the following is true (a) fluorescence corresponds to singlet/triplet transition (b) fluorescence emission band occurs at a wavelength shorter than the excitation band (c) intersystem crossing process increases fluorescence (d) fluorescence intensity increases with increasing incident beam power.
12. For an empty cell for infrared spectrometry, 12 interference peaks was observed in the region of  $1250$  to  $1480\text{ cm}^{-1}$ . What is the path length of the cell? (a)  $0.052\text{ cm}$   
(b)  $0.026\text{ cm}$  (c)  $0.013\text{ cm}$  (d)  $0.007\text{ cm}$ .
13. If a NMR instrument provides a magnetic field of  $4.8\text{ T}$ , what is the absorption frequency of  $^1\text{H}$  (the magnetogyric ratio of  $^1\text{H}$  is  $2.68 \times 10^8$ )?  
(a)  $50\text{ MHz}$  (b)  $100\text{ MHz}$  (c)  $150\text{ MHz}$  (d)  $200\text{ MHz}$ .
14. Which of the following sources of molecular mass spectrometry is more suitable for nonvolatile sample? (a) electron-impact (b) field ionization  
(c) chemical ionization (d) fast atom bombardment.
15. An ion-selective electrode exhibits a potential of  $0.270\text{ V}$  for a solution containing  $1 \times 10^{-3}\text{ M}$  of metal anion  $\text{M}^{2+}$ , what will be the concentration of  $\text{M}^{2+}$  in an unknown solution which gives a potential of  $0.211\text{ V}$ ? (a)  $1.0 \times 10^{-5}$  (b)  $5.25 \times 10^{-6}$  (c)  $5.25 \times 10^{-6}$   
(d)  $1.0 \times 10^{-1}$ .
16. Which of the following electrochemical methods does not need a calibration curve?  
(a) anodic stripping voltammetry (b) potentiometry (c) cyclic voltammetry (d) coulometry
17. According to the van Deemeter equation the plate height,  $H$ , for a chromatographic column is related to the multiple flow paths coefficient,  $A$ , longitudinal diffusion coefficient,  $B$ , and mass transfer between phases coefficient,  $C$ . Which of these coefficients is independent on the linear mobile phase flow rate? (a)  $A$ , (b)  $B$ , (c)  $C$  (d) none of them.

(背面仍有題目，請繼續作答)

系所組別： 化學系

考試科目： 分析化學

考試日期： 0307 · 節次： 4

※ 考生請注意：本試題 可 不可 使用計算機

18. Suggest a type of liquid chromatography that would be suitable for the separation of  $C_4H_9COOH$  and  $C_5H_{10}COOH$ . (a) adsorption (b) ion-exchange (c) reverse-phase partition (d) normal-phase partition.
19. Which of the following statements is not true for supercritical fluid chromatography? (a) It can not be used for thermally unstable and volatile species (b) it exhibits less band spreading than gas-liquid chromatography (c) it is ordinarily faster than HPLC (d) like gas-liquid chromatography, it can use flame ionization detector.
20. Electrochromatography is a hybrid of capillary electrophoresis and HPLC. Which of the following is true? (a) the mobile phase is driven by electroosmotic-flow and a mechanical pump (b) the column is usually packed with a normal-phase HPLC packing (c) it is capable of separate uncharged species (d) the column is packed with a GLC packing.

## 二、計算與問答題：(20%)

1. (6%) For the number 116.0, 97.9, 114.2, 106.8, and 108.3, find the mean, and standard deviation. If the value of  $Q$  for rejection of data is 0.64, decide whether the number 97.9 should be discarded?
2. (6%) (a) Explain why the presence of phosphate may reduce the flame atomic absorption peak of calcium. (b) Explain why such peak depression can be eliminated by the addition of EDTA. (c) Write the full name of EDTA and suggest the explanation for these observations.
3. (4%) Write the Boltzmann equation. What does it tell?
4. (4%) To support an electrochemical reaction on an electrode, mass transport of the reactants to the electrode surface is important. (a) Define the three mass transport mechanisms: diffusion, migration and convection. (b) Which mechanism is most effective?