

※ 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。

Part I. 選擇題 (單選題，每題 4 分，共 12 題，選錯不倒扣)

1. 食品中重金屬之檢驗例如鉛及鎘可使用下列哪種儀器進行測定
 - a. 火焰式原子吸收光譜法(Flame Atomic Absorption Spectrometry)
 - b. 感應耦合電漿質譜分析技術(ICP-MS)
 - c. 石墨爐式原子吸收光譜法(Graphite Furnace Atomic Absorption Spectrometry)
 - d. 以上皆可
2. 下列何者不屬間接碘滴定法(Iodometry)之誤差來源？
 - a. 碘離子受空氣氧化
 - b. 檢液容器之遮光效果
 - c. 硫代硫酸鈉在滴定過程中分解
 - d. 澱粉指示劑混濁度
3. $\text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow 2\text{HCl}(\text{g})$ ，此反應的濃度平衡常數 K_C 與分壓平衡常數 K_P 之關係式為何？
 - a. $K_C = K_P (RT)^1$
 - b. $K_P = K_C$
 - c. $K_P = 0$
 - d. $K_P = K_C = (RT)^1$
4. 薄層層析法的分離原理為下列哪一個作用？
 - a. 離子交換
 - b. 溶解
 - c. 吸附
 - d. 分子滲透
5. 分光光度計所採用的方形測光管(Cell)，一般而言是以何種材質進行紫外光之量測？
 - a. 塑膠管
 - b. 石英管
 - c. 玻璃管
 - d. 以上皆可
6. 定量食鹽的含量可使用下列何項方法？
 - a. 甲醛滴定法
 - b. 氧化還原滴定法
 - c. 碘滴定法
 - d. 硝酸銀滴定法
7. Which of the following methods can be used to measure the size of silver nanoparticle?
 - a. Size exclusion chromatography (SEC)
 - b. Dynamic light scattering (DLS)

- c. Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES)
d. Electrospray Ionisation Mass Spectrometry (ESI-MS)
8. 25 ppm=? %
a. 0.00025%
b. 0.0025%
c. 0.025%
d. 0.25%
9. Which of the following chromophores has the longest absorption 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. $\text{H}_2\text{C}=\text{CHCH}=\text{CHCH}=\text{CH}_2$
d. $\text{H}_2\text{C}=\text{CHCH}=\text{CH}_2$
10. Which of the following factors can influence the analytical retention time?
a. Boiling temperature and polarity of the compound
b. Column temperature
c. Flow rate of the carrier gas
d. All of above
11. Select a detector that is more sensitive for UV/Vis UV-Vis spectrophotometer:
a. Photovoltaic cell
b. Phototube
c. Photomultiplier tube
d. Diode-Array Detector
12. The determination of total serum protein is an important clinical measurement and use in diagnosing liver malfunction. Thus, which of the following analytical methods can be used to determine the protein content in clinical diagnosis?
a. Kjeldahl method
b. Mohr method
c. Volhard method
d. Gravimetric method

Part II. 計算與問答題 (共 6 題)

1. $\text{Cu}^{2+} + 4\text{NH}_3 \rightleftharpoons \text{Cu}(\text{NH}_3)_4^{2+}$ 之 $K_C = 2 \times 10^{12}$ ，若將 0.4M CuSO_4 與 1.8M 氨水等體積混合，達成平衡時 $[\text{Cu}^{2+}]$ 近於多少 M? (5%)
2. 食品中之塑化劑(鄰苯二甲酸酯類)目前已有檢驗方法可以進行分析，然而因塑化劑普遍存在於環境中，因此檢驗時應先透過什麼處理，以排除來自操作過程之汙染? (5%)

3. A 50.0 mL portion of an HCl solution required 29.71 mL of 0.01963 M Ba(OH)₂ to reach an endpoint with bromocresol green indicator. Calculate the molar concentration of the HCl. (10 %)
$$\text{Ba(OH)}_2 + 2\text{HCl} \rightarrow \text{BaCl}_2 + 2\text{H}_2\text{O}$$
4. Try to explain the principle of Beer's law and its limitations. (10 %)
5. Describe the difference between 'normal' phase and 'reverse' phase packings for high performance liquid chromatography (HPLC). Of the two, which is the most common for HPLC applications? Comparing two species A and B (with A more polar than B) explain the elution order using a normal phase and a reverse phase column. (12 %)
6. Please describe principles, applications and components of gas chromatography (GC) in detail. (10 %)