

科目：分析化學

系所組：化學系碩士班甲組

- The concentration of sugar (glucose, $C_6H_{12}O_6$) in human blood ranges from about 80 mg/100 mL before meals to 120 mg/100mL after eating. Find the molarity of glucose in blood before and after eating. (FM of $C_6H_{12}O_6 = 180.2$) (4 points)
- Which of the following bases would be most suitable for preparing a buffer of pH 9.00: (i) NH_3 (ammonia, $K_b = 1.76 \times 10^{-5}$); (ii) $C_6H_5NH_2$ (aniline, $K_b = 3.99 \times 10^{-10}$); (iii) H_2NNH_2 (hydrazine, $K_b = 1.05 \times 10^{-6}$); (iv) C_5H_5N (pyridine, $K_b = 1.58 \times 10^{-9}$)? (6 points)
- The Kjeldahl procedure was used to analyze 256 μL of a solution containing 37.9 mg protein/mL. The liberated NH_3 was collected in 5.00 mL of 0.0336 M HCl, and the remaining acid required 6.34 mL of 0.010 M NaOH for complete titration. What is the weight percent of nitrogen in the protein? (N = 14) (10 points)
- A solution contains 0.0500 M Ca^{2+} and 0.0300 M Ag^+ . Can 99% of Ca^{2+} be precipitated by sulfate without precipitating Ag^+ ? What will be the concentration of Ca^{2+} when Ag_2SO_4 begins to precipitate? (K_{sp} for $CaSO_4$ is 2.4×10^{-5} , for Ag_2SO_4 is 1.5×10^{-5}) (10 points)
- The A, B and C values of the Van-Deemter equation for a GC column with 3-m length are 0.10cm, 0.40cm²/s, and 0.05 sec, respectively. (1) Please explain that $V = (B/C)^{1/2}$ for minimum HETP. (4 points) (2) Calculate this 3-m GC column minimum HETP and theoretical plate when column at minimum HETP. (6 points)
- Substances A and B have retention time of 16.40 and 17.63 min, respectively, on a 30.0 cm column. An unretained species passes through column in 1.30 min. The peak widths (at base) for A and B are 1.11 and 1.21 min, respectively. Please calculate (a) column resolution (4 points) (b) the average plate height (3 points) (c) the length of column required to achieve a resolution of 1.5. (3 points)
- Please calculate the theoretical cell potential for the following cells.
 - SCE || Fe^{3+} (0.05 M), Fe^{2+} (0.005 M) | Pt (5 points)
 - Saturated Ag/AgCl reference || Ti^{3+} (0.01M), Ti^{2+} (0.001M) | Pt (5 points)
 Standard electrode potential:
 $Fe^{3+} + e^- \leftrightarrow Fe^{2+} \quad E_0 = 0.771V; \quad Ti^{3+} + e^- \leftrightarrow Ti^{2+} \quad E_0 = -0.369V$
- The determination of dissolved oxygen in water is a very important issue in the industry. One of the most common tools is Clark oxygen sensor. (1) Please draw a diagram of Clark oxygen sensor (5 points) (2) Describe its working principle. (5 points)

※ 注意：1. 考生須在「彌封答案卷」上作答。

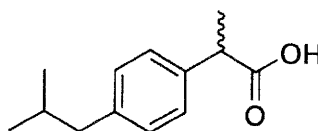
2. 本試題紙空白部分可當稿紙使用。

3. 考生於作答時可否使用計算機、法典、字典或其他資料或工具，以簡章之規定為準。

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9. Find the absorbance and transmittance of a 0.00240 M solution of a substance with a molar absorptivity of $313 \text{ M}^{-1}\text{cm}^{-1}$ in a cell with a 2.00-cm pathlength. (10 points)
10. State the advantage and disadvantage of the inductively coupled plasma compared with a flame in the atomic spectrometry. (10 points)
11. To detect the drug ibuprofen by LC-MS, would you choose the positive and negative ion mode for the spectrometer? Would you choose acidic or neutral chromatography solvent? State your reasons. (5 points)



FM = 206

12. What are the electron ionization, electrospray ionization and MALDI in mass spectrometry? (5 points)

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