

國立彰化師範大學 101 學年度碩士班招生考試試題

系所： 化學系

科目： 無機化學與分析化學

☆☆請在答案卷上作答☆☆

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I. 無機化學部分(50%)

1. The ^1H NMR spectrum of $(\text{C}_5\text{H}_5)_2\text{Fe}(\text{CO})_2$ shows two peaks of equal area at room temperature but has four resonances of relative intensity 5:2:2:1 at low temperature. Explain this phenomenon in detail. (6%)
2. Why are there two separate water exchange rates for $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$ in aqueous solution? (6%)
3. Determine the ground terms for the following configurations (a) d^4 , Td symmetry (b) d^8 , Oh symmetry. (6%)
4. What are the possible magnetic moments of Co(II) in tetrahedral and octahedral complexes. (6%)
5. The triiodide ion, I_3^- is linear, but I_3^+ is bent. Explain. (6%)
6. The ion NO^- can react with H^+ to form a chemical bond. Which structure is more likely, HON or HNO? Explain. (6%)
7. Determine the point group for (a) 1, 3, 5-tribromobenzene (b) cyclohexane, chair form (c) diborane, B_2H_6 . (6%)
8. Draw the resonance structures for isoelectronic ions NSO^- and SNO^- , and assign formal charges. (8%)

II. 分析化學(50%)

1. A 0.050 M solution of HA is 1.5% dissociated. Calculate pKa for this acid. (10%)
2. A buffer was prepared by dissolving 0.80 mol of the weak acid HA ($K_a = 1.00 \times 10^{-5}$) plus 0.20 mol of its conjugate base Na^+A^- in 0.50 L. Find the pH. (10%)
3. Calculate the ionic strength of : (10%)
 - (a) 0.08 M H_2SO_4 plus 0.01 M Na_2SO_4
 - (b) 0.5 mM MgHPO_4 plus 10.0 mM NaCl
4. Which compound has higher relative intensity of fluorescence and why? (10%)
 - (a) $\text{C}_6\text{H}_5\text{NH}_2$ or $\text{C}_6\text{H}_5\text{NH}_3^+$
 - (b) C_6H_6 or $\text{C}_6\text{H}_5\text{I}$
5. What resolution is required in order to resolve the following compounds using mass spectrometry? (10%)
 - (a) molecules $\text{C}_3\text{H}_5\text{N}_3$ ($M = 83.0484$) and $\text{C}_2\text{HN}_3\text{O}$ ($M = 83.0120$)
 - (b) ions C_2H_4^+ ($M = 28.0313$) and CO^+ ($M = 27.9949$)