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## 淡江大學 96 學年度碩士班招生考試試題

系列：化學學系

科目：普通化學

准帶項目請打「V」

本試題共 | 頁

1. A lake may be polluted with  $\text{Pb}^{2+}$  ions. How might you qualitatively test for  $\text{Pb}^{2+}$ ? (10%)
2. Write a balanced equation for the oxidation reaction of potassium dichromate with ethanol in acidic aqueous solution. (10%)
3. A sample of solid potassium chlorate ( $\text{KClO}_3$ ) was heated in a test tube and decomposed to release oxygen gas. The oxygen produced was collected by displacement of water at  $22^\circ\text{C}$  at total pressure of 754 torr. The volume of the gas collected was 0.65 L, and the vapor pressure of water at  $22^\circ\text{C}$  is 21 torr. Calculate the mass of potassium chlorate in the sample that was decomposed. (10%)
4. If a 50.0 mL sample of 0.100 M HCN is titrated with 0.100 M NaOH, calculate the  $[\text{H}^+]$  of the solution at after 50.0 mL of NaOH have been added. (10%)
5. When 2.00 mol of  $\text{SO}_2(\text{g})$  react completely with 1.00 mol of  $\text{O}_2(\text{g})$  to form  $\text{SO}_3(\text{g})$  at  $25^\circ\text{C}$  and a constant pressure of 1 atm, 198 kJ of energy are released as heat. Calculate  $\Delta\text{H}$  and  $\Delta\text{E}$  for this process. (10%)
6. Calculate the cell potential at  $25^\circ\text{C}$  for a concentration cell containing iron electrodes and different concentrations of 0.01 M  $\text{Fe}^{2+}$  and 0.1 M  $\text{Fe}^{2+}$  ion in the two compartments. (10%)
7. Predict the molecular structure and the bond angles for each of the following.  
a.  $\text{IF}_3$     b.  $\text{XeF}_4$     c.  $\text{BrF}_5$  (10%)
8. Draw molecular orbital energy diagram for  $\text{N}_2^+$  molecule. Assign orbital symmetry ( $\sigma$ ,  $\sigma^*$ ,  $\pi$ ,  $\pi^*$ ) on this diagram. Calculate the bond order for  $\text{N}_2^+$ . (10%)
9. Draw the packing diagram of two types of closest packed of crystal. Indicate the octahedral hole and tetrahedral hole in the closest packed crystal. (10%)
10. Draw a structure and explain the following terms:  
a. tertiary amine    b. poly-aromatic hydrocarbon    c. conjugated polyene (10%)

Data you may used:

Atomic weight: K 39.1, O 16.0, Cl 35.5, Cr 52.0

Gas constant  $R = 0.08206 \text{ L}\cdot\text{atm}\cdot\text{K}^{-1}\cdot\text{mol}^{-1} = 8.3145 \text{ J}\cdot\text{K}^{-1}\cdot\text{mol}^{-1}$ HCN  $K_a = 6.2 \times 10^{-10}$