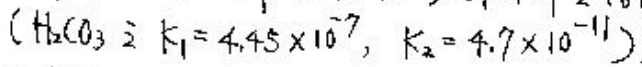


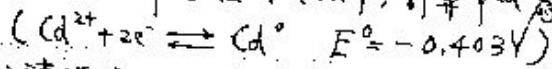
1. (40%) 解釋下列專有名詞, 每小題 5 分。

- | | |
|-------------------------|------------------------------|
| a. autoprotolysis | e. equivalence point |
| b. black-body radiation | f. faradic current |
| c. calomel electrode | g. iodimetric method |
| d. detection limit | h. thin layer chromatography |

2. (10%) 計算 BaCO_3 ($K_{sp} = 5.1 \times 10^{-9}$) 於水中之溶解度?



3. (10%) 電池 $\text{SCE} \parallel \text{Cd}^{2+} (\text{X M}) \mid \text{Cd}$, 測出電位為 -0.723 V , 於不考慮 IR drop 而極化電位下, 計算 p_{Cd} 為何?



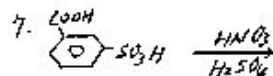
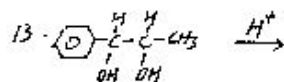
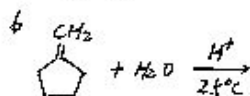
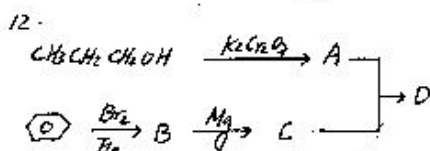
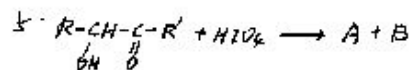
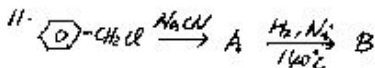
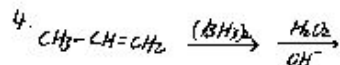
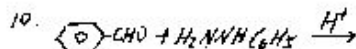
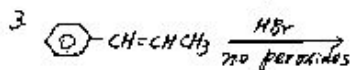
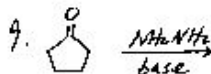
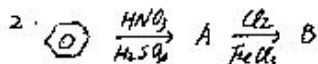
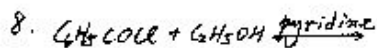
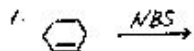
4. (10%) 請說明 DSC 與 DTA 於儀器設計而應用上的差異。

5. (10%) 請衍導 Beer's law 及說明使用限制。

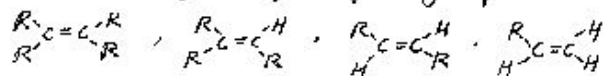
6. (10%) 原子吸收光譜儀 (AA) 有三種不同原子化方法, flame, electrothermal 而 hydride 說明之。

7. (10%) 於 GC 方法中, 請說明三種用於農藥殘留分析的檢測器。

A. Give the major products of the following reactions: 76%
(每個答案4分, 其中第2, 5, 11題有兩個答案; 第12題有4個答案)

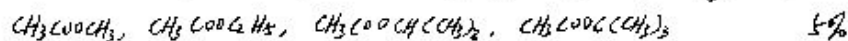


B. Give the stability order of the following compounds: 5%



C. Say 1° alcohol gives negative test of iodoform test, is it right? 5%

D. Give the relative rate of alkaline hydrolysis of the following compounds:



E. What is the intermediate of the reaction: c1ccc(cc1)X $\xrightarrow[\text{NH}_3]{\text{NH}_2^-}$ c1ccc(cc1)NH_2 5%

F. Which conformation of cyclohexane is the most stable? 4%

(第一頁共一頁)

一. Name (a) $[\text{Co}(\text{en})_2\text{CO}_3]\text{Cl}$ (b) $[\text{Cr}(\text{NH}_3)_2(\text{H}_2\text{O})_2\text{Br}(\text{Cl})]^+$ in English.
20%

二. Determine the point groups, the structures, and the most possible shapes for the following:
20%

(a) S_8 (b) P_4 (c) O_3 (d) N_3^-

三. List the following acids in order of acid strength in aqueous solution:
20%

(a) HF HCl HBr HI

(b) HCl HClO HClO_2 HClO_3 HClO_4

四. Find the number of unpaired electrons, magnetic moment, ground state term symbols, and ligand field stabilization energy for each of the following complexes:
20%

(a) MnO_4^- (b) $\text{Fe}(\text{H}_2\text{O})_6^{3+}$

五. On the basis of the 18-electron rule, determine the expected charge on the following: ($Z = ?$)
20%

(a) $[\text{Ru}(\text{CO})_4(\text{GeMe}_3)]^z$ (b) $[(\eta^5\text{-C}_5\text{H}_5)\text{Fe}(\text{CO})_3]^z$

(第一頁, 共一頁)

(1-8 : 5 points each ; 9 : 10 points)

1. If the radius of atom A is one-half the radius of atom B, which has the larger mean free path? Describe how you arrived at your answer.
2. Why is ΔS not a satisfactory criterion of chemical spontaneity? What properties are satisfactory and under what conditions?
3. Describe the relationships between the two free energies and work.
4. Describe the thermodynamic basis of the colligative properties of solution, using boiling point elevation as an illustration.
5. For two substances A and B, sketch a pressure-composition diagram that illustrates positive deviation from Raoult's law. Label the major areas and describe briefly the cause of positive deviation.
6. Derive the expression for calculating the work done by an ideal gas (a) in a constant pressure expansion from V_1 to V_2 isothermally (b) in a reversible expansion from V_1 to V_2 isothermally
7. For a second-order reaction of type $2A \rightarrow$ products, the initial concentration of A was 0.40 M. After 2 minutes, the concentration was 0.38 M. Find the rate constant.
8. Find the cell potential at 298 K of a cell composed of a Sn^{2+} -Sn electrode with activity of $\text{Sn}^{2+} = 0.15$ and a Cu^{2+} -Cu electrode with activity of $\text{Cu}^{2+} = 0.7$.
 $\text{Cu}^{2+} + 2e^- \rightarrow \text{Cu} \quad E^0 = 0.337 \text{ V}$
 $\text{Sn}^{2+} + 2e^- \rightarrow \text{Sn} \quad E^0 = -0.136 \text{ V}$
9. Figure 1 is a phase diagram for two solids A and B.
 (a) What is point b called?
 (b) What is point c called?
 (c) If the system initially is at point a ($X_B = 0.6$) and is cooled slowly,
 (1) what will the first change be?
 (2) describe what happens when the temperature reaches T_c .
 (3) what is the system like at temperatures below T_c ?

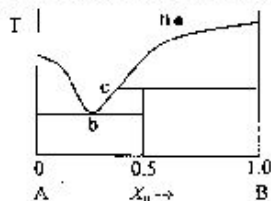


Figure 1

10. Give the Hamiltonian operator and wave function of the following systems: (a) particle in the box (1-d), (b) H atom, (c) He atom and (d) H_2 molecule. (28)

11. Describe (a) rotational constant and (b) Frank-Condon principle. (22)

(第一頁, 共一頁)

1. Describe briefly [A] the construction of a hybrid plasmid containing the pBR322 vector and a segment of foreign DNA and [B] the general method for detecting hybrid plasmid containing cells [Please give diagrams] 25%
2. Describe briefly the hormonal regulation of cellular process through membrane receptors, adenylate cyclase and cAMP-dependent protein kinases [please give diagrams] 25%
3. Describe briefly the citric acid cycle in relation with the electron transport [please give diagrams] 25%
4. Explain the high energy character of phosphoanhydride bonds of ATP [please give diagrams] 25%

(第一頁,共一頁)