東吳大學 107 學年度碩士班研究生招生考試試題

系級	化學系碩士班	考試時間	100 分鐘
科目	綜合化學	本科總分	100 分

※請標明題號後，依序作答於答案卷上。

Part A:

第一部分每題 5 分, 共 5 題。

1. For the reaction $2A + B + 2C \rightarrow D + 2E$, the rate law is: rate $=k[A]^2[B]^1[C]^1$.
   Which of the following statements is false:
   (A) the reaction is second order in [A]
   (B) the reaction is first order in [B]
   (C) the reaction is second order in [C]
   (D) the reaction is 4th order overall

2. The energy level of hydrogen atom is $-13.6\ eV/n^2$, where n is the quantum number. Please calculate the emission energy from the fourth excited state to the first excited state?

3. The Arrhenius Law states that rate constant $k = A \exp(-E_a/RT)$. The activation energy (E_a) of a reaction can be determined from the slope of which of the following graphs?
   (A) ln k vs T
   (B) (ln k)/T vs T
   (C) T/(ln k) vs 1/T
   (D) (ln k) vs 1/T

4. According to LeChatelier's Principle the addition of heat to the following reaction of $CO_{2(g)} + 2\ H_2O_{(g)} \rightarrow CH_{4(g)} + 2\ O_{2(g)}$ will cause it to move forward. This reaction can therefore be described as
   (A) spontaneous (B) endothermic (C) adiabatic (D) exothermic reaction.

5. An atom containing two electrons which possess the following quantum numbers,
   n = 3, l = 1, m_l = 1, m_s = -1/2 and l = 1, n = 3, m_s = -1/2, m_l = 1
   may not exist based on:?
   (A) Pauli's Exclusion Principle
   (B) Hund's rule
   (C) Heisenberg's Uncertainty Principle
   (D) Bohr's model

第二部分

6. Show your understanding of the Born-Harber cycle by calculating the heat of formation of potassium fluoride. (5 分)
7. Obtain the ground-state term symbols for C, N, Co^{2+}, Fe^{2+} and Cr^{3+}. (5 分，每小題 1 分)
8. Predict the number of unpaired electrons for each of the following (a) a tetrahedral d^6 ion (b) high-spin $[Co(H_2O)_6]^{2+}$ (c) $[Cr(H_2O)_6]^{3+}$ (d) a square-planar d^7 ion (e) a coordination compound with a magnetic moment of 5.1 Bohr magnetons. (5 分，每小題 1 分)
9. Explain the following terms: (a) *Spectrochemical* series (b) 18-electron Rule (c) oxidative addition and reductive elimination reaction (d) linkage isomers (e) paramagnetic and diamagnetic compounds. (10 分，每小題 2 分)

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Part B:

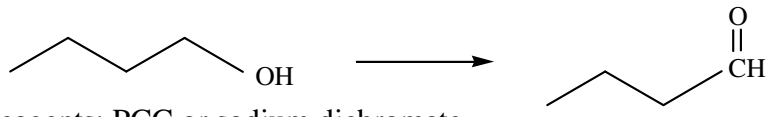
1. Give the structure for each of the following names: (10 分)

(a) cyclopentanone (b) phenol (c) pyridine

(d) chair form of *cis*-1,2-diethylcyclohexane (e) acetone

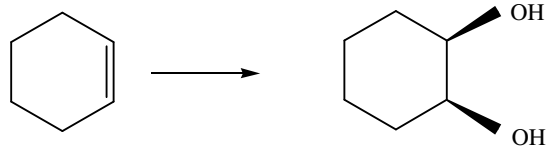
2. Select the correct reagents and write down the structures for each of the following reactions: (6 分)

a)



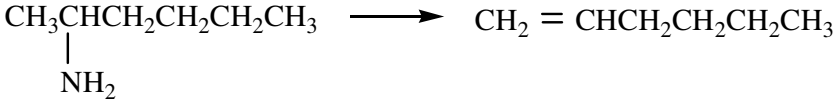
reagents: PCC or sodium dichromate

b)



reagents: MCPBA or osmium tetraoxide and hydrogen peroxide

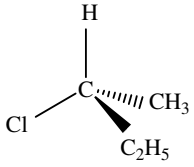
c)



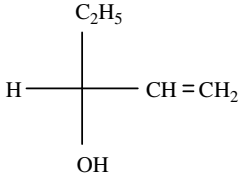
reagents: hydrogen chloride or 1)exess methyl iodide2)silver oxide3) heat

3. Label each chiral carbon as (R) or (S). (4 分)

(a)



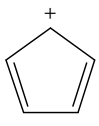
(b)



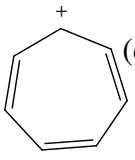
4.Classify each of the followings as aromatic(A), antiaromatic(anti) or nonaromatic(N). (5 分)

(a)

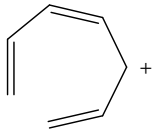
(b)



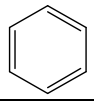
(c)



(d)



(e)



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5. (15 分) Define the following terms:
   (a) phosphorescence
   (b) Beer's law
   (c) IR spectroscopy
   (d) electrospray ionization
   (e) flame ionization detector

6. (5 分) Describe van Deemter equation and discuss the effect of particle size of LC stationary phase on plate height

7. (5 分) Calculate the pH of 0.1M NaA (HA: Ka= 2.5×10^{-5}) solution