

東吳大學 106 學年度碩士班研究生招生考試試題

第 1 頁，共 3 頁

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:

- 1.(15 分) Define the following terms
 - (a) Photomultiplier tube
 - (b) Phosphorescence
 - (c) Flame ionization detector of GC

- 2.(5 分) Describe the advantages of FTIR

- 3.(5 分) 100mL of 0.1M HA ($K_a=1 \times 10^{-5}$) solution was titrated with 0.1M of NaOH solution. Calculate the pH at equivalence point.

- 4.(5 分) For the reaction $2A + B + 2C \rightarrow D + 2E$, the rate law is: $\text{rate} = k[A]^2[B]^1[C]^1$. 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

- 5.(5 分) The energy level of hydrogen atom is $-13.6 \text{ eV}/n^2$, where n is the quantum number. Please calculate the excitation energy from the ground state to the first excited state??

- 6.(5 分) In the combustion of propane, $C_3H_8(g) + 5 O_2(g) \rightarrow 3 CO_2(g) + 4 H_2O(g)$, which reactant has the greatest rate of disappearance?
 - (A) $C_3H_8(g)$
 - (B) $O_2(g)$
 - (C) $CO_2(g)$
 - (D) $H_2O(g)$

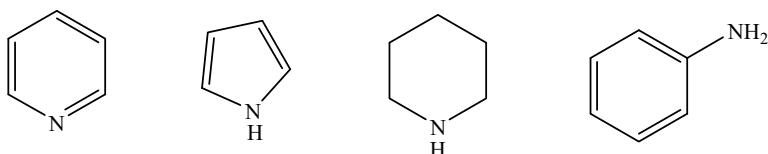
- 7.(5 分) What is the point group for O_3 ?

- 8.(5 分) Which of the following is NOT a state property?
 - (A) pressure (P)
 - (B) temperature (T)
 - (C) internal energy (U)
 - (D) work (W)

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Part B:

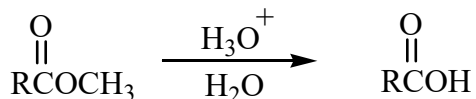
1.(5 分) Rank the following compounds in order of decreasing basicity.



2.(4 分) Draw the more stable conformation for each of the following compounds:

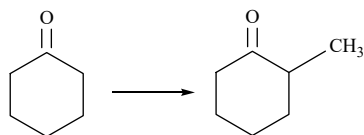
- (a) *cis*-1-ethyl-4-methylcyclohexane
 (b) *trans*-1-ethyl-3-methylcyclohexane

3.(4 分) Give the mechanism for the following reaction:

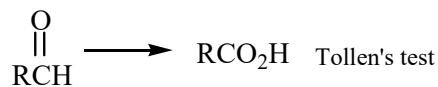


4.(4 分) Provide the appropriate reagents for each of the following conversions:

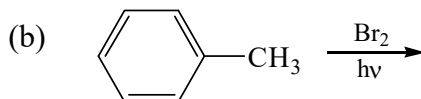
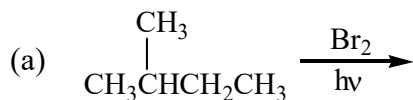
(1)



(2)

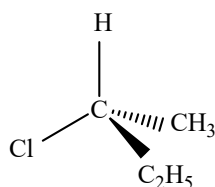


5.(4 分) Give the major product for each of the following reactions:

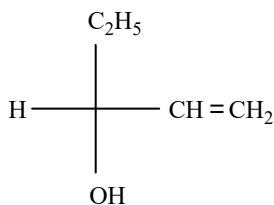


6.(4 分) Label each chiral carbon as (R) or (S).

(a)



(b)



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7.(10 分) For each of the following molecules, predict the molecular geometry and give the expected hybrid orbitals on the central atom (a) XeF_4 (b) ClF_3 (c) SF_4 (d) XeF_2 (e) IF_5 (每個兩分)

8.(5 分) 請問下列各組中的化合物，何者的沸點較高？(a)、 LiCl or HCl ；(b)、 NH_3 or PH_3 ；(c)、 Xe or I_2 ；(d)、 $\text{CH}_3\text{CH}_2\text{OH}$ or $\text{CH}_3\text{CH}_2\text{CH}_3$ ；(e)、丁烷或環丁烷。(每個一分)

9.(10 分) 三個五公升的容器，固定其壓力計與閥，在 273 K 下，各容器內有 4 g 的氣體。A 容器為 H_2 (分子量 2)，B 容器為 He (原子量 4)，C 容器為 CH_4 (分子量 16)，請比較三個容器內(a) pressure (b) average molecular kinetic energy (c) density (d) collision frequency (e) 閥打開後之 diffusion rate 的大小 (每個兩分)