

國立成功大學

111學年度碩士班招生考試試題

編 號： 77

系 所： 化學工程學系

科 目： 有機化學

日 期： 0219

節 次： 第 1 節

備 註： 不可使用計算機

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第 1 頁，共 3 頁

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Multiple-Choice Questions (each 2%, total 10 %)

(1) Which of the following is true for the initiation step of a free radical chlorination reaction?

- A)  $\Delta H^\circ > 0$  and  $\Delta S^\circ > 0$
- B)  $\Delta H^\circ > 0$  and  $\Delta S^\circ < 0$
- C)  $\Delta H^\circ < 0$  and  $\Delta S^\circ > 0$
- D)  $\Delta H^\circ < 0$  and  $\Delta S^\circ < 0$
- E)  $\Delta H^\circ = 0$  and  $\Delta S^\circ = 0$

(2) HBr can be added to an alkene in the presence of peroxides (ROOR). What function does the peroxide serve in this reaction?

- A) nucleophile
- B) electrophile
- C) radical chain initiator
- D) acid catalyst
- E) solvent

(3) Absorption of what type of electromagnetic radiation results in electronic transitions?

- A) X-rays
- B) radio waves
- C) microwaves
- D) ultraviolet light
- E) infrared light

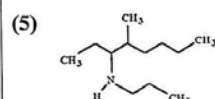
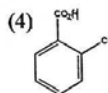
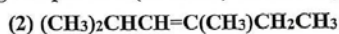
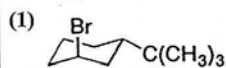
(4) A correct order of reactivity of acid derivatives towards nucleophilic attack is \_\_\_\_\_.

- A) esters > acid anhydrides > amides
- B) anhydrides > amides > esters
- C) carboxylates > esters > amides
- D) anhydrides > acids > acid chlorides
- E) anhydrides > amides > carboxylates

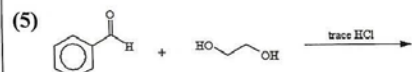
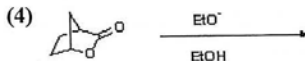
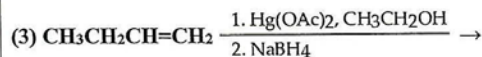
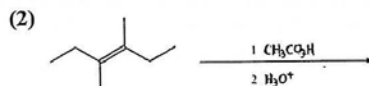
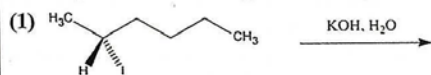
(5) What compound is produced when *N,N*-dimethylpropanamide is treated with  $\text{LiAlH}_4$ ?

- A)  $\text{CH}_3\text{CH}_2\text{CONH}_2$
- B)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$
- C)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
- D)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{N}(\text{CH}_3)_2$
- E)  $\text{CH}_3\text{CH}_2\text{N}(\text{CH}_3)_2$

2. Assign the IUPAC names for the following compounds. (each 2%, total 10 %)



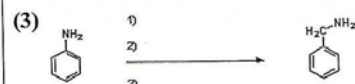
3. Complete the following reactions. (each 2%, total 10%)



4. Complete the following multiple-step transformation. (each 5%, total 20%)

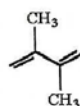


(2) synthesis of 3-heptanone from propanal

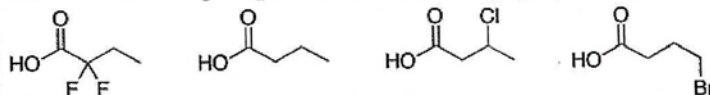


(4)  $(\text{CH}_3\text{CH}_2\text{O}_2\text{C})_2\text{CH}_2$  to cyclopentanecarboxylic acid

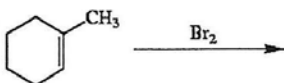
5. Draw the structure of the major product which results when the diene shown is treated with HBr at  $-80^\circ\text{C}$  and  $40^\circ\text{C}$ , respectively. (5%)



6. Rank the following compounds in order of acidity. (5%)

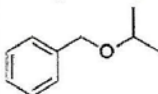


7. Complete the following reaction and provide a detailed, step-by-step mechanism for the process. (5%)



8. Compound I has a molecular formula of  $\text{C}_7\text{H}_{16}$ . In  $^{13}\text{C}$  NMR, compound I gave 3 peaks and in  $^1\text{H}$  NMR it also gave 3 peaks, a doublet, a triplet and a multiplet. Provide a structure for compound I. (5%)

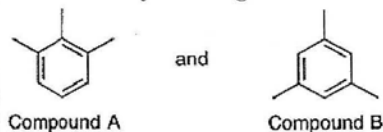
9. Propose fragmentations to account for the 59, 73, and 107 peaks in the MS of the ether below. (5%)



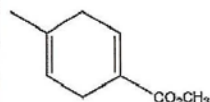
10. Provide a detailed, stepwise mechanism for the acid-catalyzed transesterification of ethyl acetate with *n*-propanol. (5%)

11. Draw a mechanism and provide the structure of the aldol product that results when 4-methylpentanal is heated with sodium hydroxide. (5%)

12. How could you distinguish the two compounds below using  $^1\text{H}$  and proton decoupled  $^{13}\text{C}$  NMR? (5%)



13. What diene and dienophile are used in the Diels-Alder route to the compound shown? (5%)



14. (-)-Lactic acid has a specific rotation of  $-3.8^\circ$ . What is the specific rotation of a solution containing 7.5 g of (-)-lactic acid and 2.5 g of (+)-lactic acid? (5%)