

1140PC1

國立臺北科技大學 114 學年度碩士班招生考試

系所組別：3700 分子科學與工程系有機高分子碩士班

第一節 有機化學 試題

第 1 頁 共 2 頁

注意事項：

1. 本試題共三大題，每題分別為 50 分、30 分和 20 分，共 100 分。
2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

第一大題 單選題 (共 10 小題，每小題 5 分，共計 50 分)

1. () Which of the following compounds is the monomer for making polycarbonate? (5 pts)
(A) Bisphenol A.
(B) Terephthalic acid.
(C) Styrene.
(D) Ethylene glycol.
2. () What is the major product when benzene reacts with acetyl chloride (CH_3COCl) in the presence of aluminum chloride (AlCl_3)? (5 pts)
(A) Benzaldehyde.
(B) Acetophenone.
(C) Toluene.
(D) Benzyl alcohol.
3. () Which polymerization mechanism is most suitable for the synthesis of polystyrene? (5 pts)
(A) Step-growth polymerization.
(B) Free radical chain-growth polymerization.
(C) Condensation polymerization.
(D) Ionic polymerization.
4. () Which of the following statements about aromaticity is correct? (5 pts)
(A) Aromatic compounds must have a conjugated system with $4n$ π -electrons.
(B) Aromatic compounds are always more reactive than alkenes in addition reactions.
(C) Benzene undergoes electrophilic substitution rather than addition due to its aromaticity.

(D) Aromatic compounds must contain alternating single and double bonds.

5. () Which of the following polymers is NOT an example of a step-growth polymer? (5 pts)
(A) Nylon-6,6.
(B) Polyethylene.
(C) Polyethylene terephthalate.
(D) Polycarbonate.
6. () Which type of hybridization is present in the carbon atom of methane (CH_4)? (5 pts)
(A) sp
(B) sp^2
(C) sp^3
(D) sp^3d
7. () Which of the following pairs of compounds are structural isomers? (5 pts)
(A) Butane and isobutane.
(B) cis-2-butene and trans-2-butene.
(C) Ethanol and methanol.
(D) Propane and ethylene.
8. () What is the major product when methane reacts with chlorine under UV light? (5 pts)
(A) Methanol
(B) Chloroform
(C) Chloromethane
(D) Dichloromethane
9. () When ethene reacts with HBr, the product is? (5 pts)
(A) Ethanol
(B) Bromoethene
(C) 1-Bromoethane
(D) 2-Bromoethane
10. () Which of the following statements about enantiomers is true? (5 pts)
(A) They are diastereomers of each other.
(B) They are superimposable mirror images.
(C) They rotate plane-polarized light in opposite directions.
(D) They have different molecular formulas.

注意：背面尚有試題

第二大題 簡答題 (共 6 小題, 每小題 5 分, 共計 30 分)

1. Explain the difference between a nucleophile and an electrophile, and provide an example of each. (5 pts)
2. Describe the mechanism of the aldol condensation reaction between two molecules of acetaldehyde (ethanal). (5 pts)
3. What is **Markovnikov's rule**, and how does it apply to the addition of hydrogen bromide (HBr) to propene? (5 pts)
4. Outline the steps involved in the Gabriel synthesis of primary amines, starting from phthalimide. (5 pts)
5. Design a synthetic route to convert benzene into *m*-bromo-nitrobenzene. (5 pts)
6. Design a complete synthetic pathway to convert phenol (C₆H₅OH) into 4-aminophenol (C₆H₄OH-NH₂). Your answer must include: (5 pts)
 - (1) Reagents and conditions for each step.
 - (2) The name of the reaction or mechanism involved (if applicable).
 - (3) Structures of intermediate compounds.
 - (4) Explanation for the order of steps to ensure selectivity.

第三大題 配合題 (共 2 小題, 每小題 10 分, 共計 20 分)

《Answers formatted clearly in sequence from Column A to Column C》

1. Match the **reaction type** in Column A with the corresponding reagent(s) in Column B and the product(s) in Column C. (10 pts)

Column A: Reaction Types
(1). Aldol Condensation
(2). Diels-Alder Reaction
(3). Friedel-Crafts Alkylation
(4). Grignard Reaction
(5). Hydroboration-Oxidation
Column B: Reagent(s)
A. BH ₃ •THF, H ₂ O ₂ /NaOH
B. AlCl ₃ , RCOCl
C. Diene + Dienophile
D. NaOH, heat

E. RMgX, H ₃ O ⁺
Column C: Product(s)
a. Alcohol (anti-Markovnikov addition)
b. β-Hydroxy aldehyde or ketone
c. Six-membered ring
d. Ketone or alcohol (from carbonyl compounds)
e. Aryl ketone

2. Match the **spectral characteristic** in Column A with the corresponding functional group or compound in Column B and the spectroscopy technique in Column C. (10 pts)

Column A: Spectral Characteristics
(1). A strong peak around 1700 cm ⁻¹ in the IR spectrum.
(2). A molecular ion peak (M ⁺) at 58 in the MS spectrum.
(3). A doublet at ~1.2 ppm in the ¹ H-NMR spectrum.
(4). A triplet at ~9.5 ppm in the ¹ H-NMR spectrum.
(5). A broad peak around 3200-3600 cm ⁻¹ in the IR spectrum.
Column B: Functional Group or Compound
A. Alcohol
B. Aldehyde
C. Ketone
D. Isopropyl group
E. Carboxylic acid
Column C: Spectroscopy Technique
a. IR Spectroscopy
b. Mass Spectrometry (MS)
c. ¹ H-NMR Spectroscopy