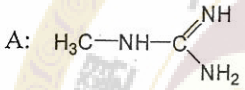
國立臺灣大學101學年度碩士班招生考試試題

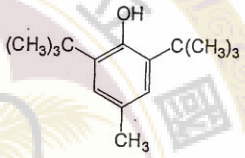
※注意：請於試卷上「非選擇題作答區」作答，並註明作答之題號。

1. (a) Which compound has a higher dipole moment, $CHCl_3$ or CH_2Cl_2? Explain. (5%)
   (b) Diethyl ether and 1-butanol are isomers. Their boiling points and solubilities in water are shown below. Explain why these two compounds have similar solubility properties but very different boiling points. (5%)

Diethyl ether	**1-butanol**
Boiling point 35°C	Boiling point 118°C
8.4 mL dissolves in 100 mL H_2O	9.1 mL dissolves in 100 mL H_2O

2. (a) Compound A can become protonated on any of the three nitrogen atoms. Determine which nitrogen atom is the most basic. Explain your answer. (5%)
   (b) Foods containing unsaturated acids undergo oxidation in air, which is a radical reaction. Compound B is an antioxidant added to foods to interrupt the oxidation mechanism. Show how compound B works as an antioxidant. (5%)

A: 

B: 

3. Estradiol is a potent female hormone. 5.00 mg of estradiol was burned in oxygen and 14.54 mg of CO_2 and 3.97 mg of H_2O were generated. The molecular weight of estradiol was determined to be 272. Determine the molecular formula of estradiol. (6%)

4. Is $CH_3CH{=}C{=}CHCl$ a chiral molecule? If it is, explain how and draw its enantiomers. (6%)

5. What product will be yielded from cyclohexanone reacting with dimethylamine and acetaldehyde under acidic condition? Identify the name of this reaction along with its description. (10%)

6. Please describe what Dieckmann condensation is. (5%)

7. Please describe how to synthesize 4-chloro-2-propylbenzenesulfonic acid from benzene in great detail. (10%)

8. How would you prepare 1,2,4-tribromobenzene from benzene, using a diazonium replacement in your scheme? (10%)

9. Rank the following halides in order of their reactivity in the Williamson synthesis:
   (a) Bromoethane, 2-bromopropane, bromobenzene (2%)
   (b) Chloroethane, bromoethane, 1-iodopropene (3%)

10. Please describe what Merrifield Solid-Phase Method is. (10%)

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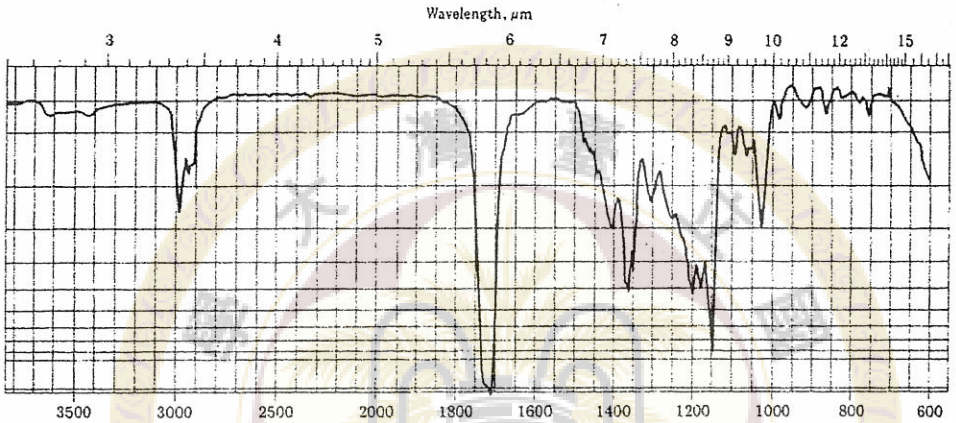
11. Please name three most useful pericyclic reactions for organic synthesis and describe each of them. (10%)

12. Use the spectra below to determine the structural formula of compound $C_7H_{12}O_3$ whose UV spectrum shows absorption at $\lambda_{max} = 275$ nm ($\epsilon = 25$, ethanol). (8%)



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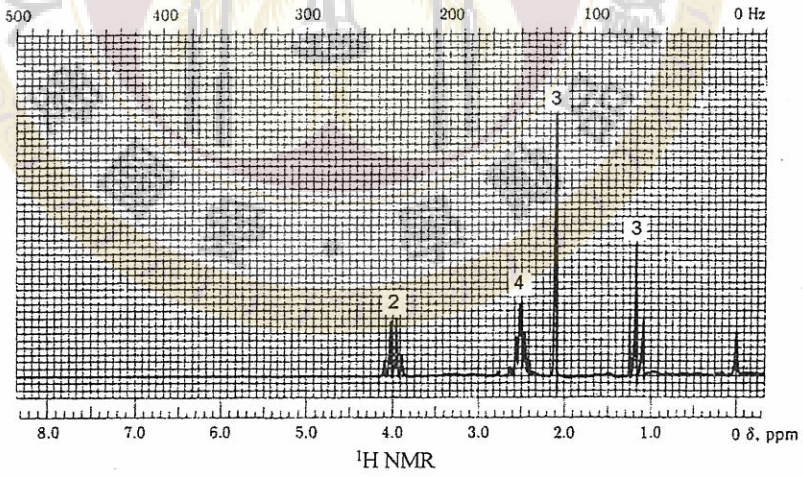

^{1}H NMR

The numbers are the relative areas.

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