

國立臺灣師範大學 103 學年度碩士班招生考試試題

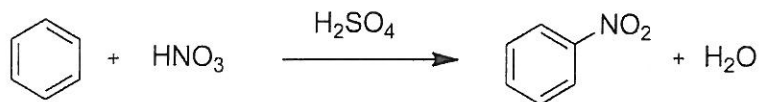
科目：有機化學

適用系所：化學系

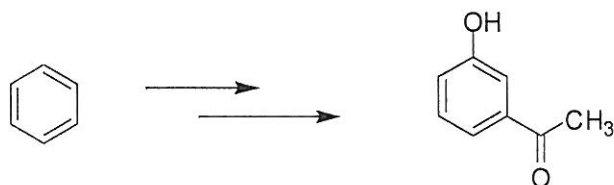
注意：1.本試題共 9 頁，請依序在答案卷上作答，並標明題號，不必抄題。2.答案必須寫在指定作答區內，否則不予計分。

I. 問答題 (共 22 分) :

1) Propose the step-wise mechanism of following reactions. (6 分)

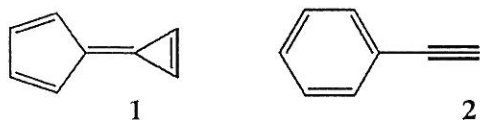


2) Propose a synthetic route for the desired product starting from benzene. Write down the product in each step. (8 分)



(Using $\text{SnCl}_2/\text{H}_3\text{O}^+$; $\text{CH}_3\text{COCl}/\text{AlCl}_3$; $\text{HNO}_2/\text{H}_2\text{SO}_4$; $\text{HNO}_3/\text{H}_2\text{SO}_4$; $\text{Cu}_2\text{O}/\text{Cu}(\text{NO}_3)_2/\text{H}_2\text{O}$)

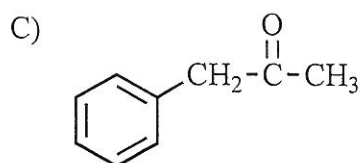
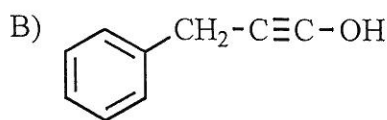
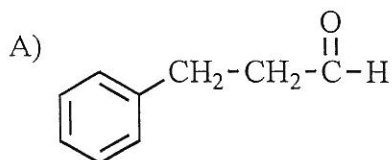
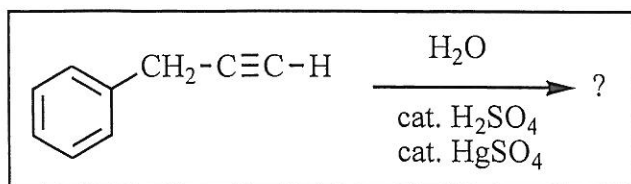
3) Compounds 1 and 2 are isomers. Which compound has a much larger dipole moment? Please give the explanation. (4 分)



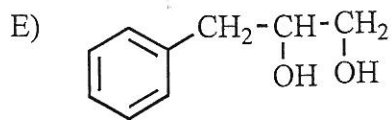
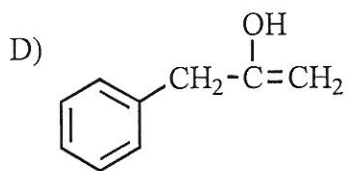
4) Please propose the reaction mechanism for the conjugate addition of Bu_2CuLi to methyl vinyl ketone, $\text{CH}_3\text{C}(\text{O})\text{CH}=\text{CH}_2$. (4 分)

II. 單選題 (每題 3 分，共 78 分):

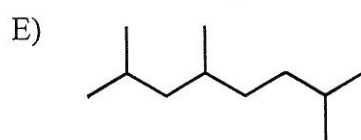
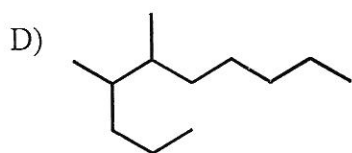
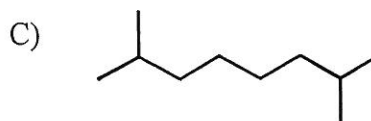
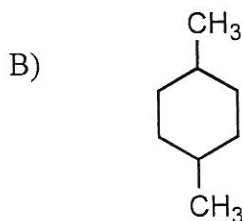
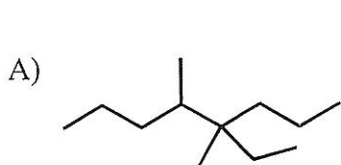
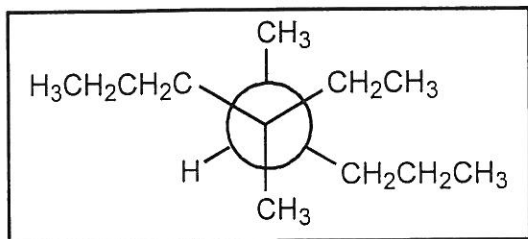
1) What would be the product of the following reaction?



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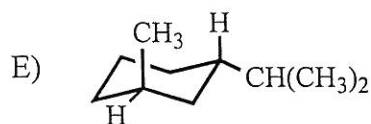
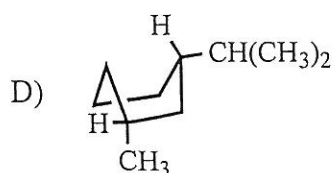
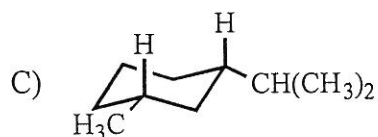
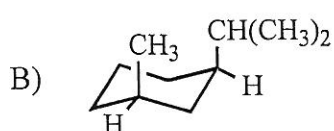
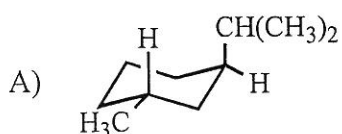
2) The following Newman projection represents which molecule?



3) In a carbon radical, the single unpaired electron resides in:

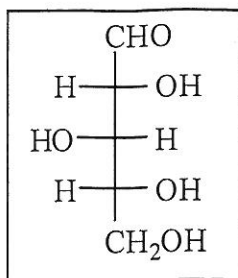
- A) sp^2 orbital B) sp^3 orbital C) s orbital D) p orbital
E) none of the above

4) Which would be the **most stable** conformation of *trans*-1-methyl-3-isopropylcyclohexane?



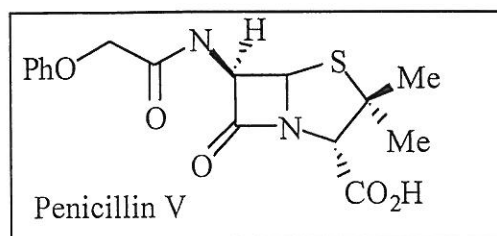
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5) What is the *R* and *S* configuration for each stereogenic center of the following sugar from top to bottom?



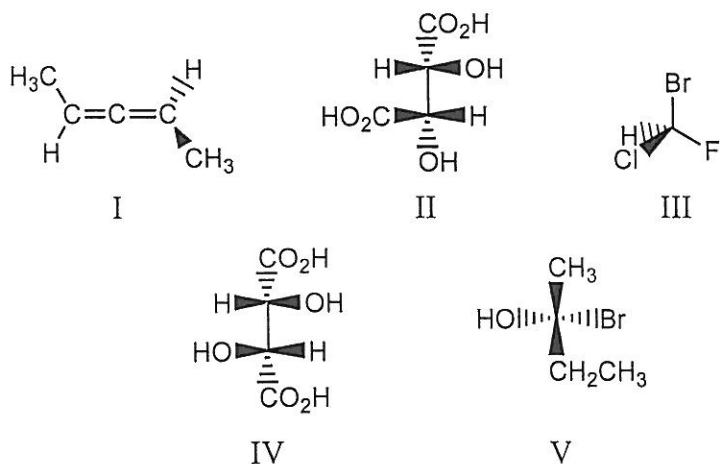
- A) *R, S, R* B) *S, S, R* C) *R, R, S* D) *R, R, R* E) *S, S, S*

6) Penicillin V was discovered in the late 1920s by Sir Alexander Fleming in which he won the Nobel Prize for the development of this wonder drug. How many stereogenic centers does penicillin V contain?



- A) 1 B) 2 C) 3 D) 4 E) 5

7) Which of the following molecules is achiral?



- A) I B) II C) III D) IV E) V

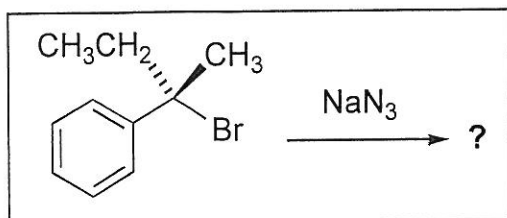
8) What is the percent composition of a mixture of (*S*)-(+)-2-butanol, $[\alpha]_D^{25} = +13.52^\circ$, and

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(R)-(-)-2-butanol, $[\alpha]_D^{25} = -13.52^\circ$, with a specific rotation $[\alpha]_D^{25} = +6.76^\circ$?

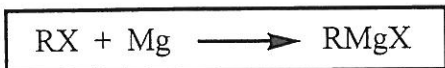
- A) 75%(R) 25%(S) B) 25%(R) 75%(S) C) 50%(R) 50%(S)
 D) 67%(R) 33%(S) E) 33%(R) 67%(S)

9) The **major** product of the following reaction conditions will result from:



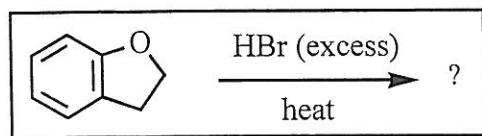
- A) S_N2 B) S_N1 C) E2 D) E1 E) there is no way to know

10) Which statement about the preparation of Grignard reagents is **not** true?



- A) The reaction must be done in an ether solvent.
 B) The reagent should be protected from air.
 C) Methyl, primary, secondary, tertiary and aryl halides may be used.
 D) Rearrangement may accompany Grignard formation.
 E) The halogen may be chloride, bromide, or iodide.

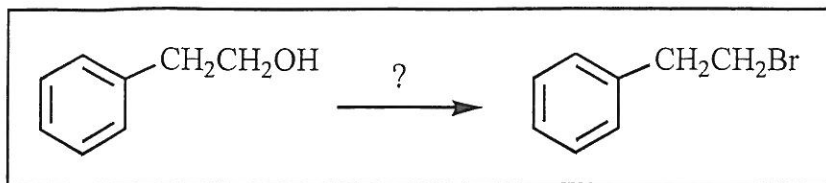
11) What product would result from the following reaction?



- A) B) C)
 D) E)

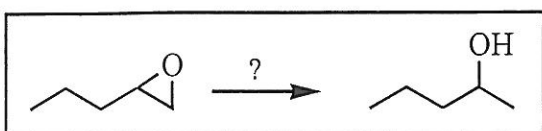
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12) What reagent would best accomplish the following reaction?



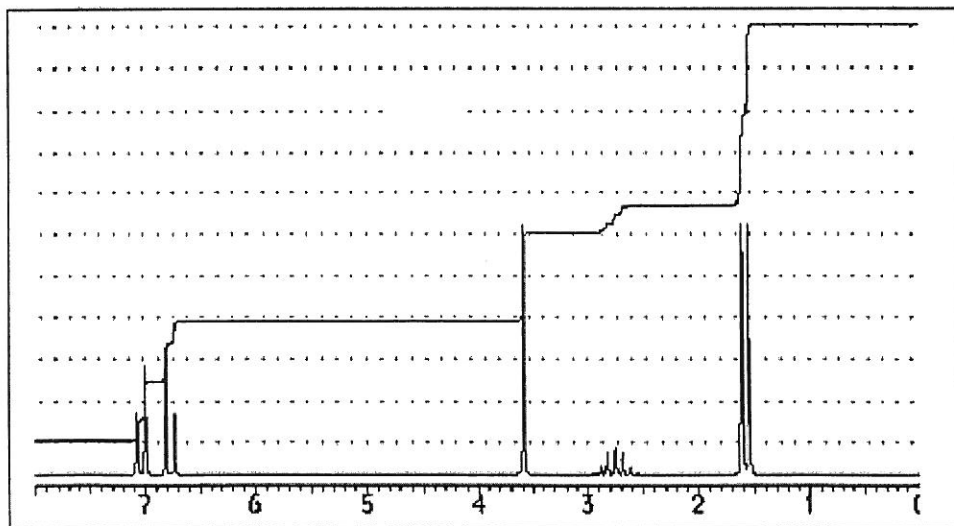
- A) Br_2 B) NaBr C) CH_3Br D) $\text{NH}_4^+ \text{Br}^-$ E) PBr_3

13) Which reagent(s) would accomplish the following reaction?



- A) $\text{H}_2\text{O}, \text{H}^+$ B) 1. NaH ; 2. H_2O C) 1. LiAlH_4 ; 2. H_2O D) $\text{NaOH}, \text{H}_2\text{O}$
 E) 1. CH_3MgBr ; 2. H_2O

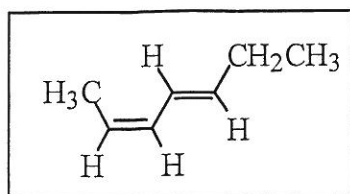
14) The following $^1\text{H-NMR}$ was most likely obtained from which of the compounds listed below?



- A) CC(C)c1ccc(OC)cc1 B) CC(C)Oc1ccc(O)cc1 C) CC(C)Oc1ccc(C)cc1
 D) CCOc1ccc(C)cc1 E) CC(C)Oc1ccc(C)cc1

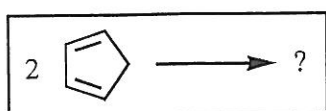
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15) What is the proper IUPAC name for the following molecule:



- A) (2*E*,4*Z*)-hepta-2,4-diene B) (2*E*,3*Z*)-hepta-2,3-diene C) (2*Z*,4*E*)-hepta-2,4-diene
 D) (2*Z*,3*E*)-hepta-2,3-diene E) (3*E*,4*Z*)-hepta-3,4-diene

16) What would be the product of the following reaction?

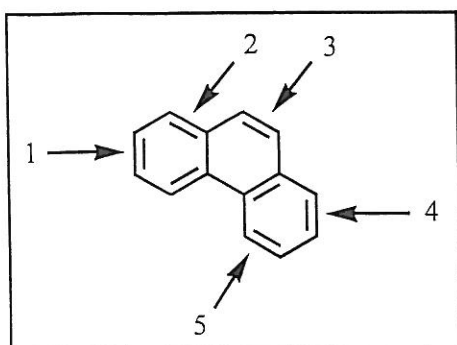


- A) B) C)
 D) E) No reaction occurs.

17) Which of the following dienes would you expect to be the most reactive in Diels-Alder reactions?

- A) B) C) D) E)

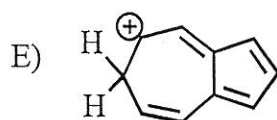
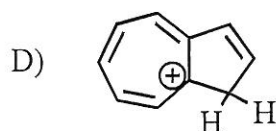
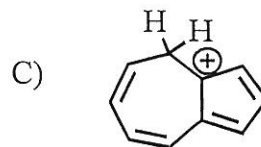
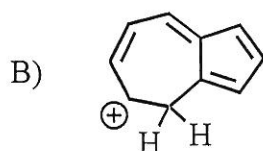
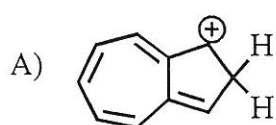
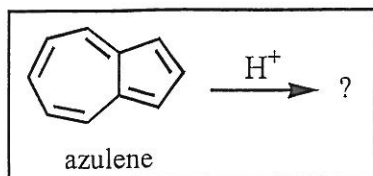
18) One of the double bonds in phenanthrene, shown below, is much more reactive than the others. Which one is it?



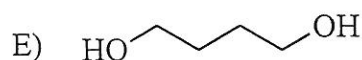
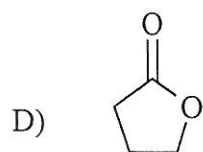
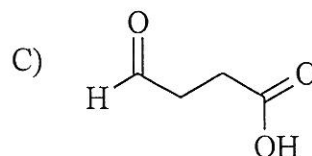
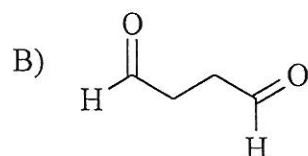
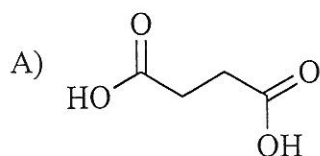
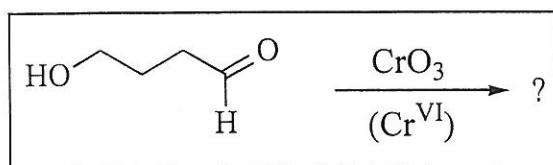
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- A) 1 B) 2 C) 3 D) 4 E) 5

19) One of the interesting aspects of azulenes is that they are soluble in strong aqueous acids because of a reaction with H^+ . Which of the structures below would represent the most stable form of protonated azulene?

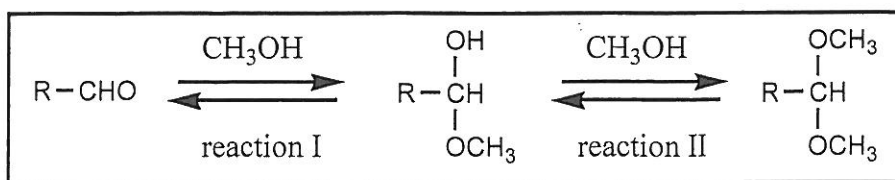


20) What product would you expect from the following reaction?



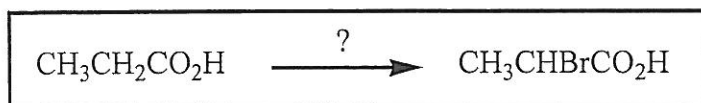
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21) Which statement is true of the following reactions?



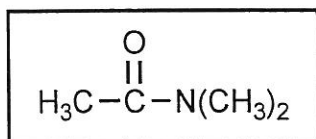
- A) Reactions I and II are only acid-catalyzed.
 B) Reaction I is catalyzed by either acid or base, but reaction II requires acid.
 C) Reactions I and II are both base-catalyzed.
 D) Reaction II is catalyzed by either acid or base, but reaction I requires acid.
 E) Both reactions I and II are catalyzed by either acid or base.

22) What reagent(s) would accomplish the following conversion?



- A) Br_2 B) PBr_3 C) Br_2/light D) $\text{Br}_2 + \text{cat. PBr}_3$ E) $\text{PBr}_3 + \text{cat. Br}_2$

23) How many different CH_3 signals would you expect in the room-temperature proton NMR spectrum of the molecule below?



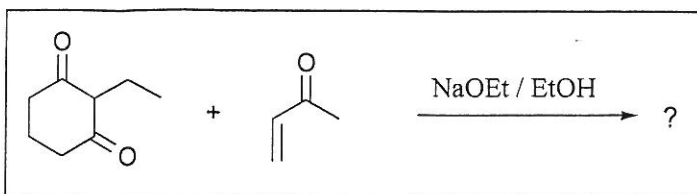
- A) One B) Two C) Three D) Four E) Five

24) What is the relative reactivity of carboxylic acid derivatives toward hydrolysis (left = least reactive)?

- A) ester < amide < acid chloride < anhydride
 B) amide < ester < acid chloride < anhydride
 C) ester < amide < anhydride < acid chloride
 D) amide < ester < anhydride < acid chloride
 E) The relative reactivities really cannot be compared.

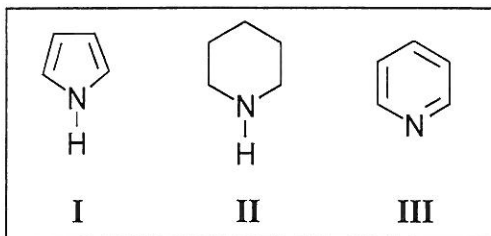
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25) Predict the **major** organic product of the following reaction.



- A)
- B)
- C)
- D)
- E)

26) How would the heterocyclic amines shown here be ranked in order of decreasing basicity (more basic > less basic)?



- A) III > I > II B) I > II > III C) II > III > I D) I > III > II E) II > I > III

