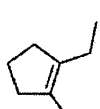
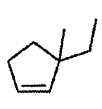
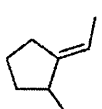
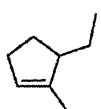
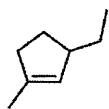
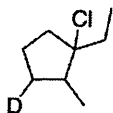


※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

Part I Multiple Choice (30%; 2% each)

1. Which of the following alkenes would produce the following molecule when treated with DCl?



A. I

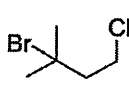
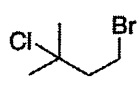
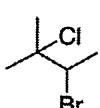
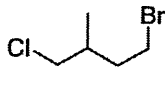
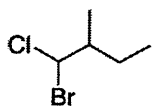
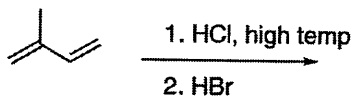
B. II

C. III

D. IV

E. V

2. Predict the major product of the following reaction sequence.



A. I

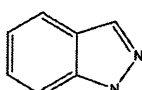
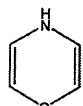
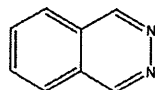
B. II

C. III

D. IV

E. V

3. How many of the following compounds are aromatic?



A. 1

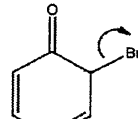
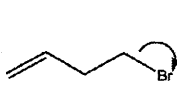
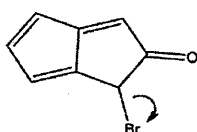
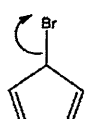
B. 2

C. 3

D. 4

E. 5

4. Which heterolysis step will occur fastest?



I

II

III

IV

V

A. I

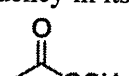
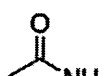
B. II

C. III

D. IV

E. V

5. Which of the following would show a C=O stretch at the lowest frequency in its IR spectrum?



I

II

III

IV

V

A. I

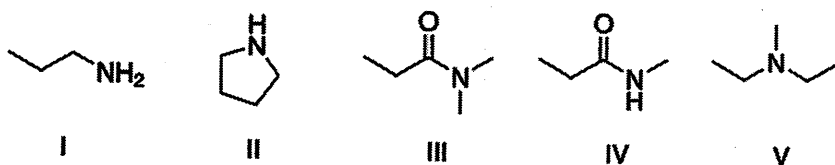
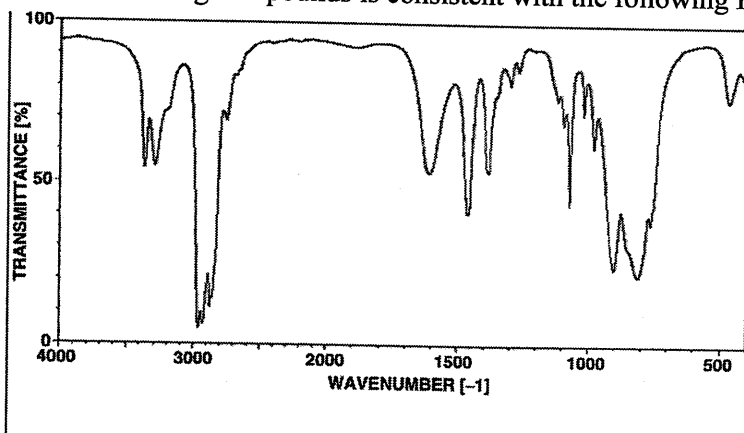
B. II

C. III

D. IV

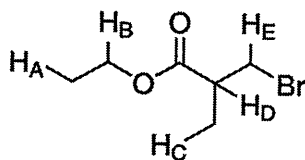
E. V

6. Which of the following compounds is consistent with the following IR spectrum?



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

7. Which hydrogen atom has the greatest chemical shift?

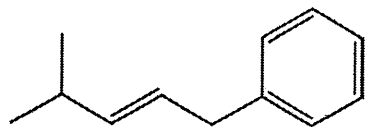


- A. H_A B. H_B C. H_C D. H_D E. H_E

8. The mass spectrum for an unknown molecule has an M⁺ peak with a relative intensity of 100 and an M + 1 peak with a relative intensity of 9.905. How many carbons are in the unknown molecule?

- A. 1 B. 5 C. 6 D. 9 E. 10

9. How many distinct ¹³C-NMR signals are expected for the following compound?

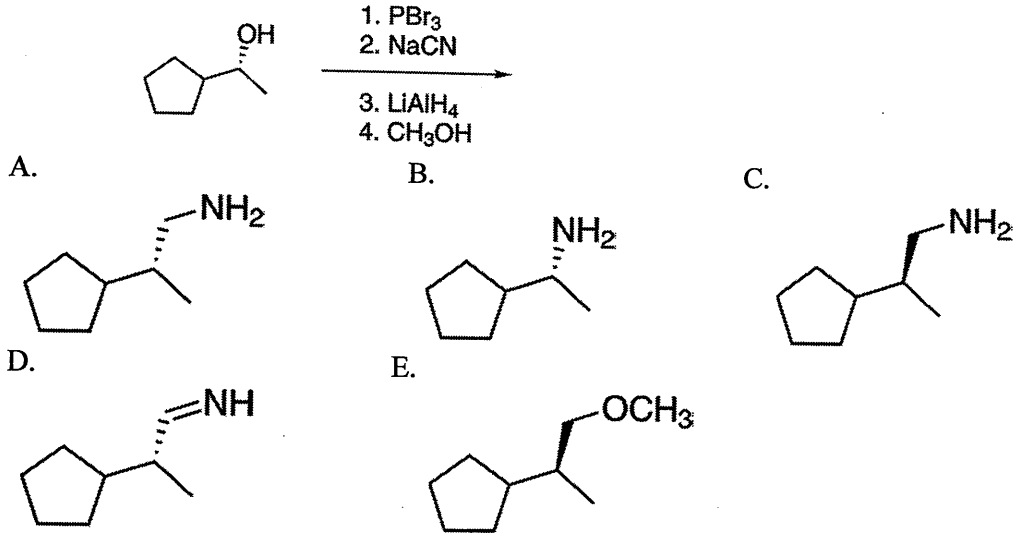


- A. 9 B. 10 C. 11 D. 12 E. 7

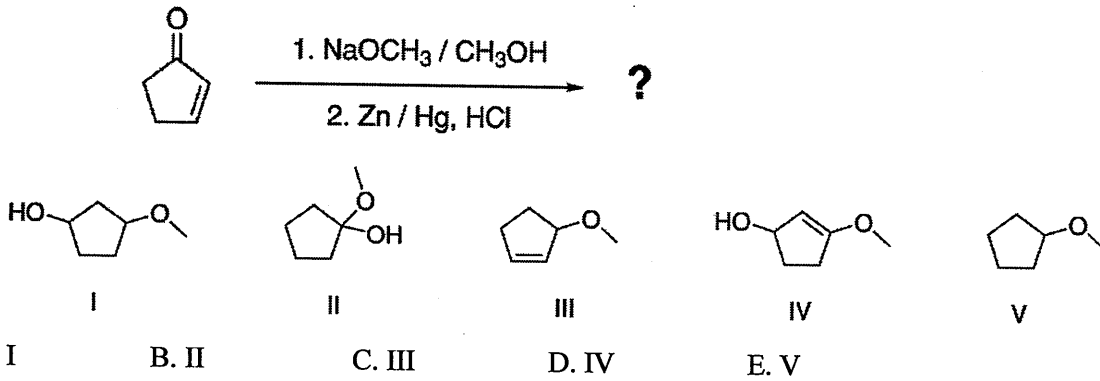
10. Which of the following is the correct order of reactivity for this set of nucleophiles?

- A. (CH₃CH₂)₂CuLi > CH₃CH₂MgBr > CH₃CH₂Li
 B. CH₃CH₂Li = CH₃CH₂MgBr > (CH₃CH₂)₂CuLi
 C. (CH₃CH₂)₂CuLi > CH₃CH₂Li > CH₃CH₂MgBr
 D. CH₃CH₂Li > CH₃CH₂MgBr > (CH₃CH₂)₂CuLi
 E. CH₃CH₂MgBr > (CH₃CH₂)₂CuLi > CH₃CH₂Li

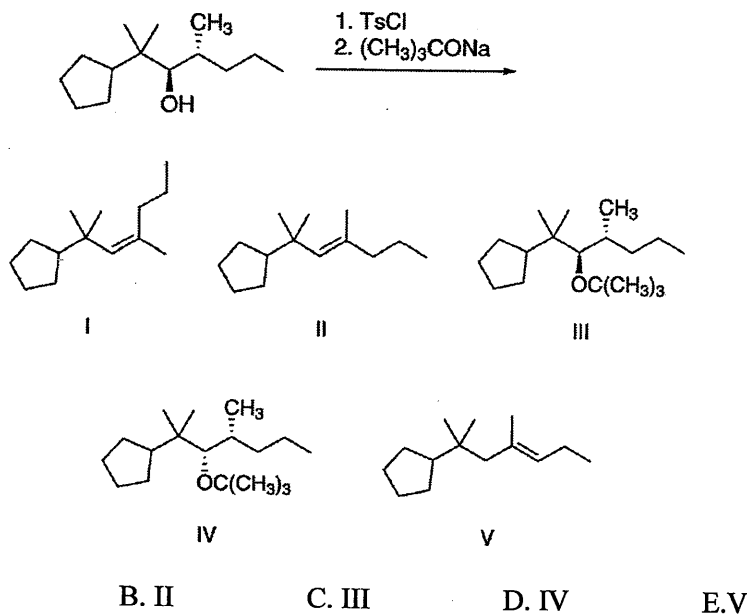
11. Predict the major product of the following synthetic scheme



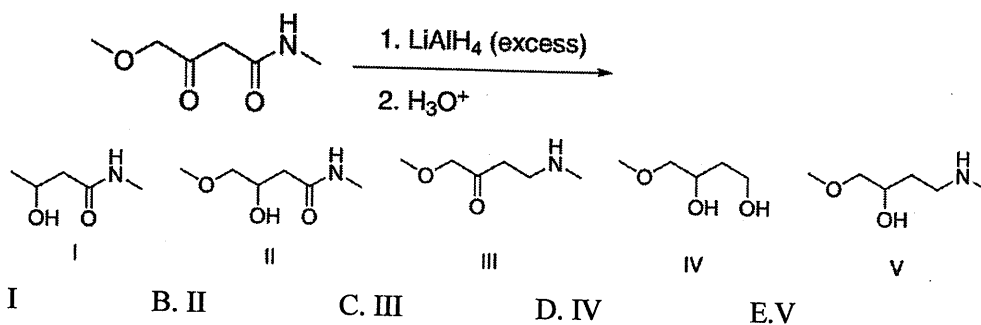
12. Predict the product of the following reaction.



13. What is the product of the following reaction sequence?



14. What is the most likely product of the following reaction?



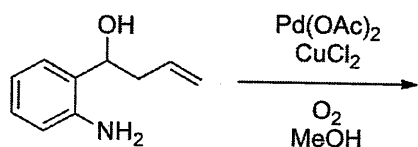
15. A pure sample of (*S*)-phenylalanine has a specific rotation of $+70^\circ$. A mixture of the two enantiomers of phenylalanine has a specific rotation of $+7.0^\circ$. What are the percentages of the *S* and *R* enantiomers in the mixture?

- A. 95% *S*, 5% *R* B. 90% *S*, 10% *R* C. 55% *S*, 45% *R* D. 58% *S*, 42% *R* E. 52.5% *S*, 47.5% *R*

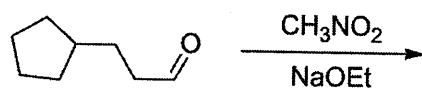
Part II

Please show the major product for the following each reaction. Be showing the stereochemistry if it exists. (30%; 3% each)

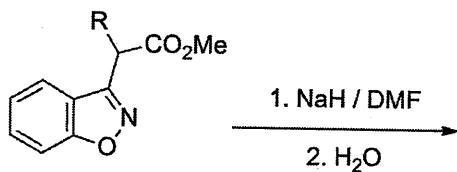
1.



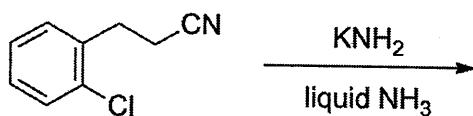
2.



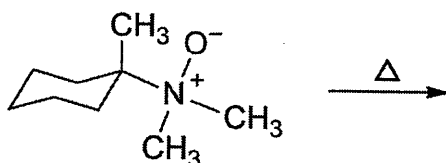
3.



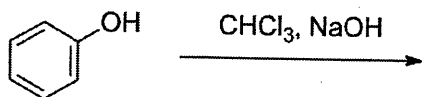
4.



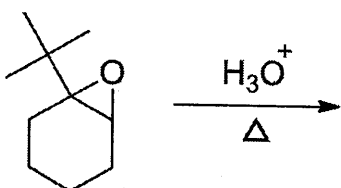
5.



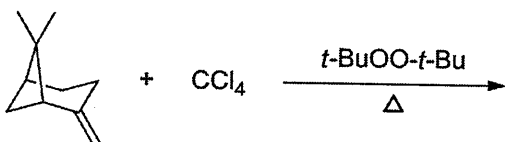
6.



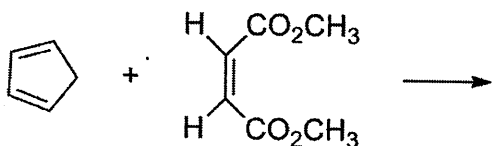
7.



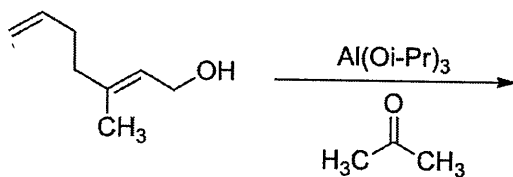
8.



9.



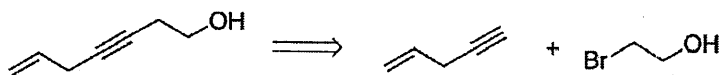
10.



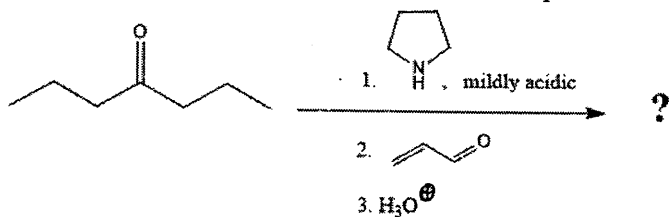
Part III

Please answer the following questions.

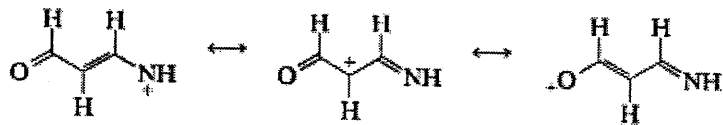
1. A student suggests the following transform. Identify the synthetic trap and propose an alternate electrophile to avoid the synthetic trap. (5%)



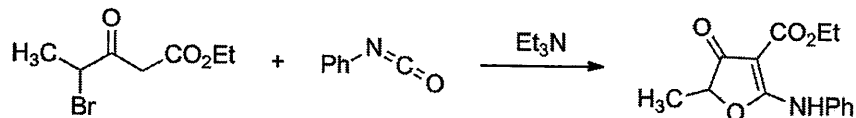
2. Write the complete, detailed mechanism and predict the major product for the following reaction. (7%)



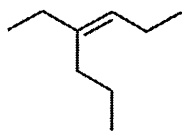
3. Do you think the delocalization as shown by the following resonance structures is important? Explain why or why not. (4%)



4. Write a reasonable mechanism for the following transformation. (8%)



5. Show how you would synthesize the molecule below using propanal as the only source of carbon present in the final product. (8%)



6. The enol ether (A) gives one of the two enantiomers B or C as the major (>96%) product. Please show the two possible chair-like transition states to deduce which enantiomer is the preferred product and show the stereodescriptor for B and C, respectively. (8%)

