

國立成功大學

113學年度碩士班招生考試試題

編 號：45

系 所：化學系

科 目：有機化學

日 期：0202

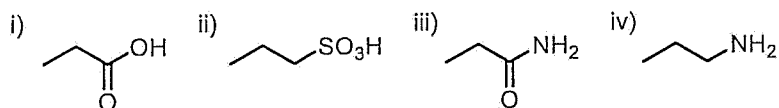
節 次：第 2 節

備 註：不可使用計算機

※ 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。

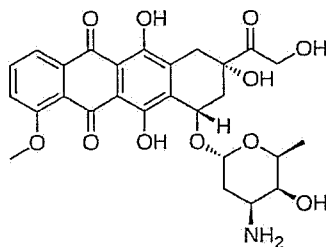
Part I. Multiple choice 每題兩分。多選題錯一選項扣一分，不倒扣。

1. Rank the following acids in the order of increasing acidity.



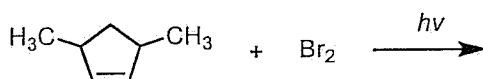
- A). iv < iii < ii < i B). iv < iii < i < ii C). iii < iv < ii < i D). iii < ii < iv < i E). ii < iii < iv < i

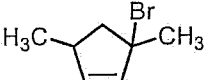
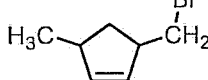
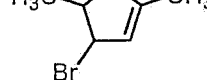
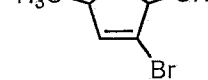
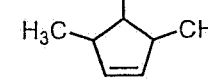
2. Doxorubicin is a chemotherapy medication used to treat cancer. Which functional groups are not present in Doxorubicin? (two functional groups)



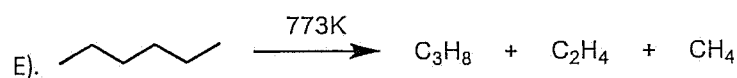
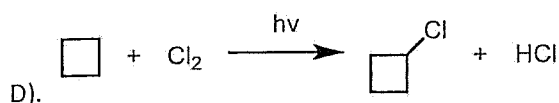
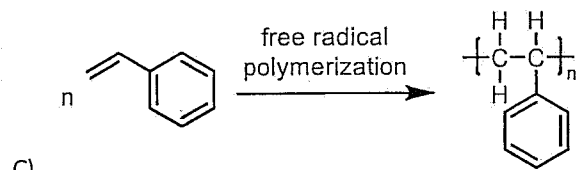
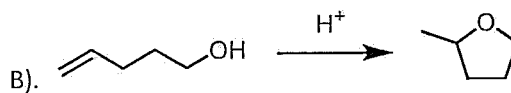
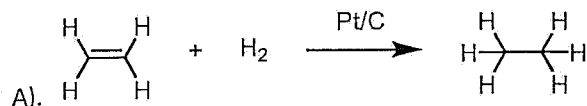
- A). phenol B). amine C). acetal D). amide E). ester

3. In the presence of a small amount of bromine, the light-promoted bromination of cyclic alkene will take place. Which of the following products will form? (two products)

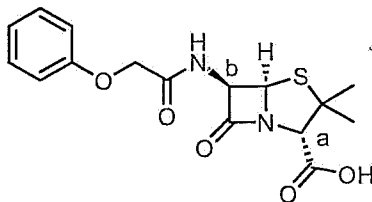


- A).  B).  C).  D).  E). 

4. In the following reactions, which one of reactions' ΔS° is positive?



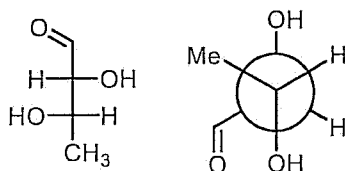
5. Indicate the chirality of the following compound.



- A). a: (R) b: (R) B). a: (R) b: (S) C). a: (S) b: (R) D). a: (S) b: (S)

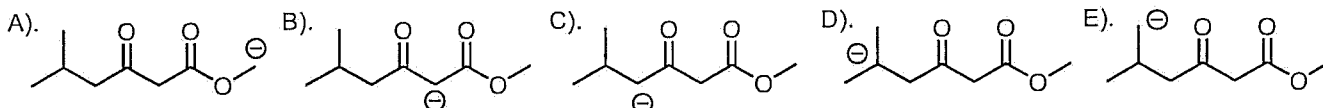
6. The specific rotation of (*R*)-carvone is -60° . What is the e.e. value of the (*R*)-enantiomer in a sample of carvone that has a specific rotation of -15° . A). 25% B). 20% C). 75% D). 80% E). 60%

7. Identify the relationship between these two molecules.

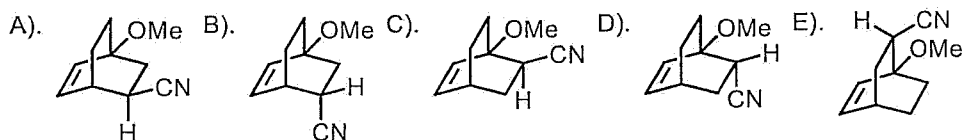
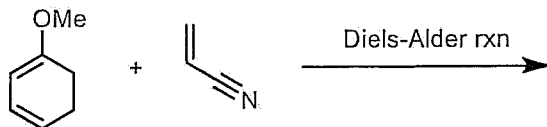


- A). Same compound B). Diastereomers C). Enantiomers D). Epimers E). Unrelated compounds

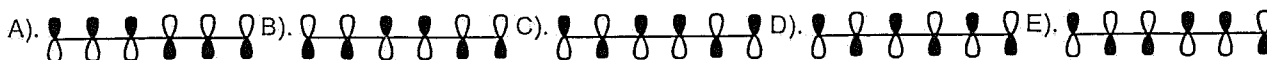
8. Which anion is the most stable anion?



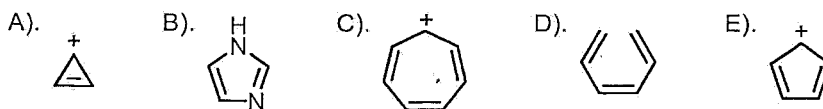
9. Which is the major product from the following reaction?



10. Which one of the following molecular orbitals of 1,3,5-hexatriene has the highest energy?



11. Which one of the following compounds is antiaromatic?

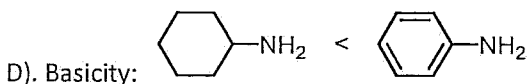


12. For the following descriptions about *cis*-1-(tert-butyl)-3-methylcyclohexane, which one is correct?

- A). If the specific rotation of this molecule is 0° , it means that this molecule has no chiral center.
 B). The boat conformation of this molecule has the lowest conformational energy.
 C). The tert-butyl and the methyl group bear a 1,3-diaxial relationship.
 D). The tert-butyl group of this molecule favors the equatorial position.
 E). The trans-isomer of this molecule is energetically more stable.

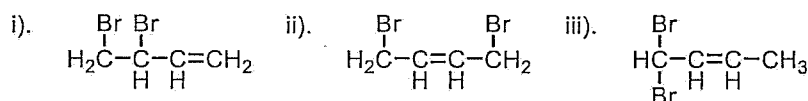
13. Which one of the following is correct?

- A). Nucleophilicity: $F^- > I^-$ B). Nucleophilicity: $(CH_3)_3CO^- > CH_3CH_2CH_2CH_2O^-$ C). Basicity: $F^- > I^-$



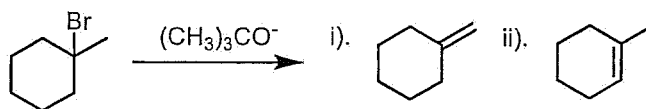
- E). Hydrophobicity: $CH_3CH_2OH > CH_3OCH_3$

14. When Br_2 is added to buta-1,3-diene at low temperature, the product mixture contains 60% of product X and 40% of product Y. When the same reaction takes place at high temperatures, the product ratio is 10% X and 90% Y. Indicate the corresponding product from the following molecules.



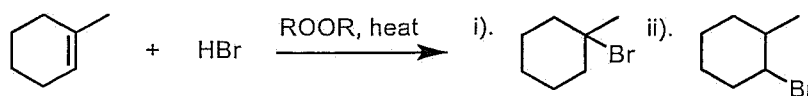
- A). X: i Y: ii B). X: i Y: iii C). X: ii Y: i D). X: ii Y: iii E). X: iii Y: i

15. For the following reaction, which molecule is the major product? And is it Hoffmann or Zaitsev product?



- A). i, Hoffmann product B). ii, Hoffmann product C). i, Zaitsev product D). ii, Zaitsev product

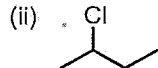
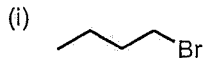
16. For the following reaction, which molecule is the major product? And does it give Markovnikov or anti-Markovnikov product?



- A). i, Markovnikov product B). ii, Markovnikov product C). i, anti-Markovnikov product
 D). ii, anti-Markovnikov product

17. In the following set of conditions, which conditions are more favorable to the S_N2 reaction?

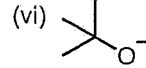
a) Substrate



b) Nucleophile



c) Nucleophile



A). a: i, b: iii, c: v

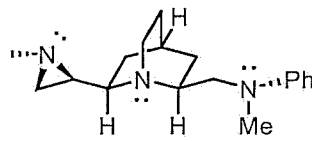
B). a: i, b: iv, c: v

C). a: i, b: iv, c: vi

D). a: ii, b: iii, c: v

E). a: ii, b: iv, c: vi

18. Nitrogen inversion racemizes the corresponding chiral center. How many chiral centers in the following molecule will not be racemized? (hint: including the chiral centers from nitrogen atoms and carbon atoms)



A). 2

B). 3

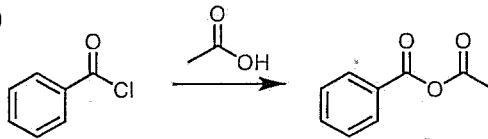
C). 4

D). 5

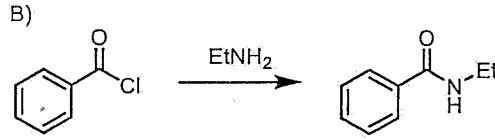
E). 6

19. Which one of the following reactions is not likely to proceed?

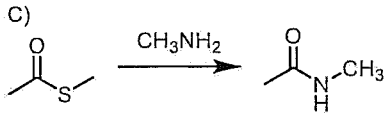
A)



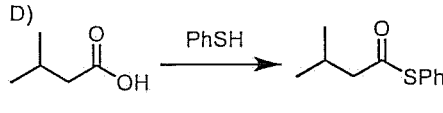
B)



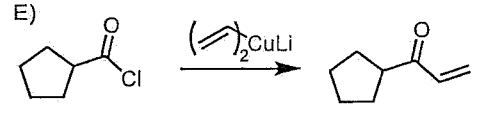
C)



D)

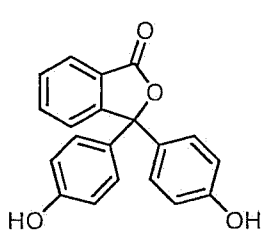


E)

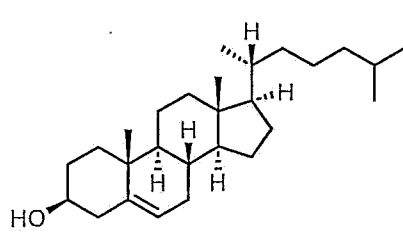


20. For the following compounds, which one has the largest value of UV absorption maxima (λ_{max})?

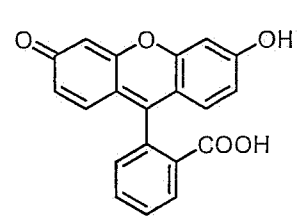
A).



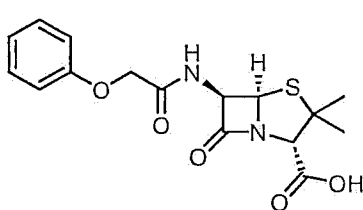
B).



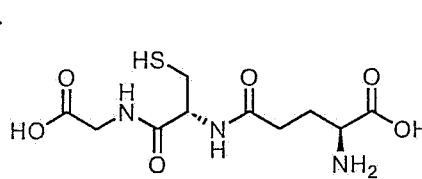
C).



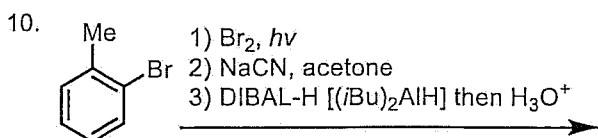
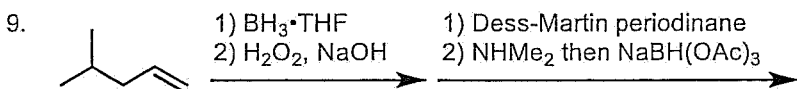
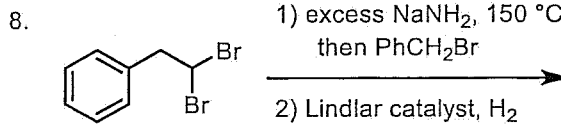
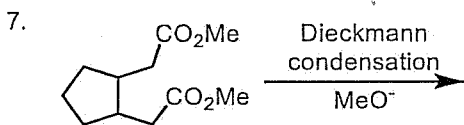
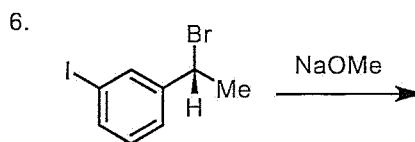
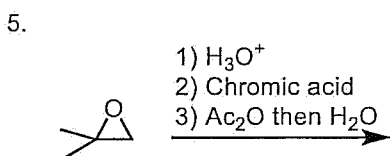
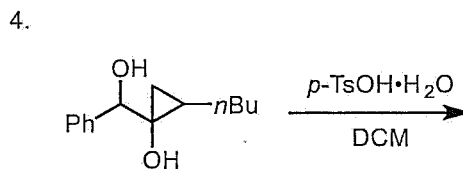
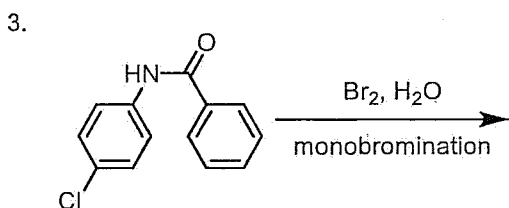
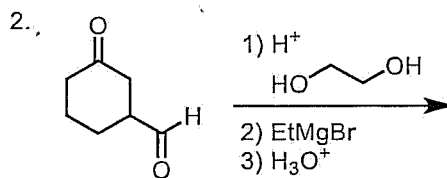
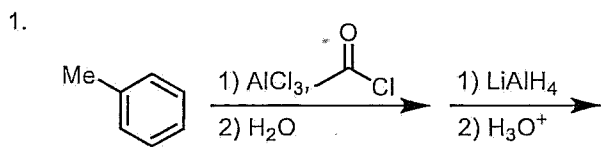
D).



E).



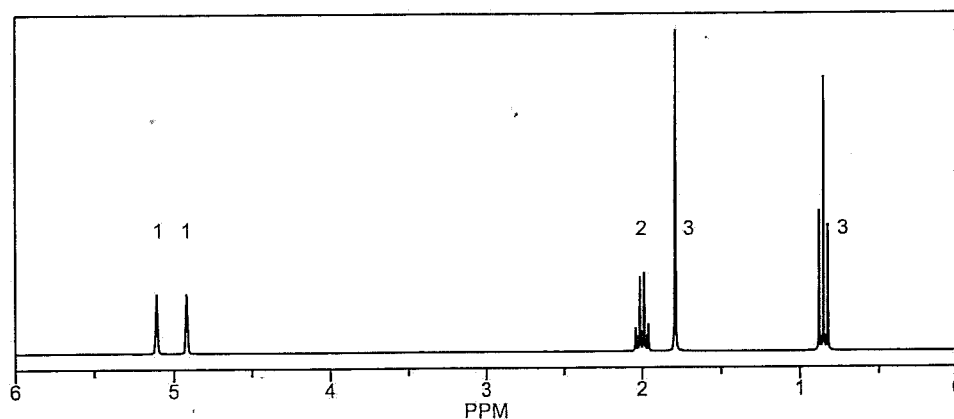
Part II. Give the major product for each of the following reactions. 每題三分



Part III. Answer the following questions.

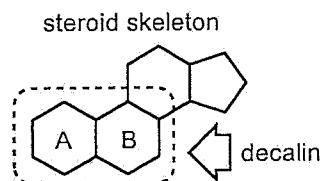
When 2-chloro-2-methylbutane is treated strong bases, the products always seem to contain two isomers of formula C_5H_{10} . The following 1H -NMR spectrum is from one of the isomers.

1. Draw chemical structures of the two isomers. (6%)
2. Which of the isomers does the 1H -NMR spectrum belong to? (2%) Please briefly explain. (4%)
3. If we would like to obtain the isomer indicated by the 1H -NMR spectrum, which base should we use, sodium hydroxide or potassium tert-butoxide? (3%)



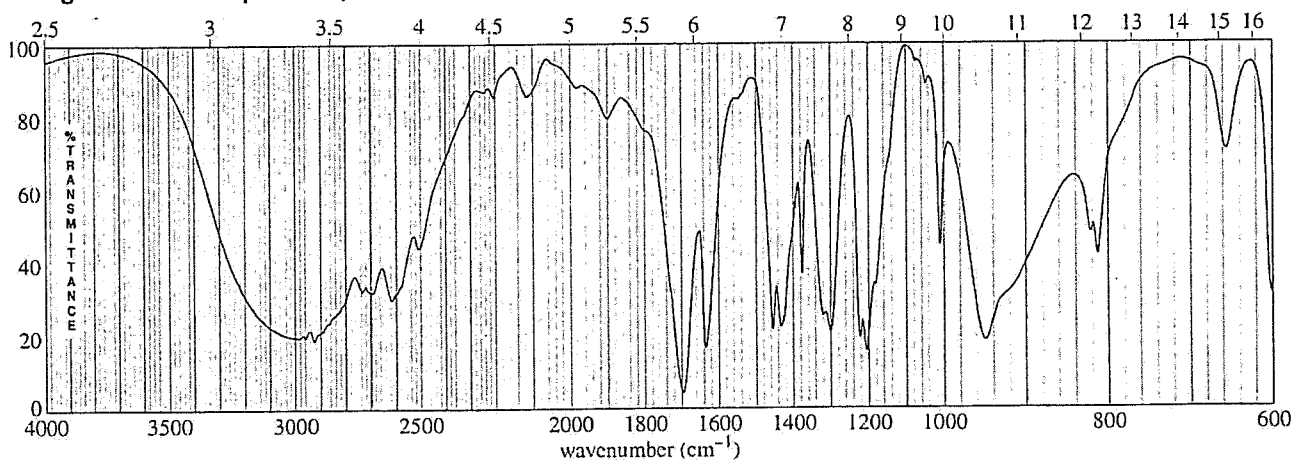
$^1\text{H-NMR}$ spectrum of the isomer. The number in the spectrum indicates the ratio of the corresponding peak areas.

Decalin has chemical formula $\text{C}_{10}\text{H}_{18}$, which is a common scaffold in various natural products, such as steroids. In the steroid skeleton, the A and B ring resembles the decalin.



4. Decalin is a bicyclic molecule. Which category of bicyclic molecules does decalin belong to? (2%)
 A). fused bicyclic compound. B). bridged bicyclic compound. C). spirocyclic compound.
 D). none of the above.
5. Draw the *cis*-decalin($\text{C}_{10}\text{H}_{18}$) in the chair conformation. (3%)

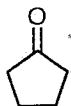
For the given infrared spectrum, it is measured from the following compounds.



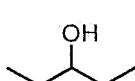
This figure was adapted from Organic Chemistry (2017), Leroy G. Wade, Jr. and Jan William Simek, Pearson Education.

6. Which compound agrees with the given infrared spectrum? (2%) Please briefly explain. (3%)

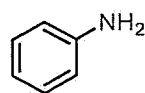
A).



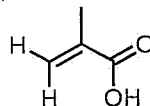
B).



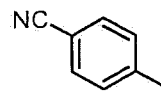
C).



D).



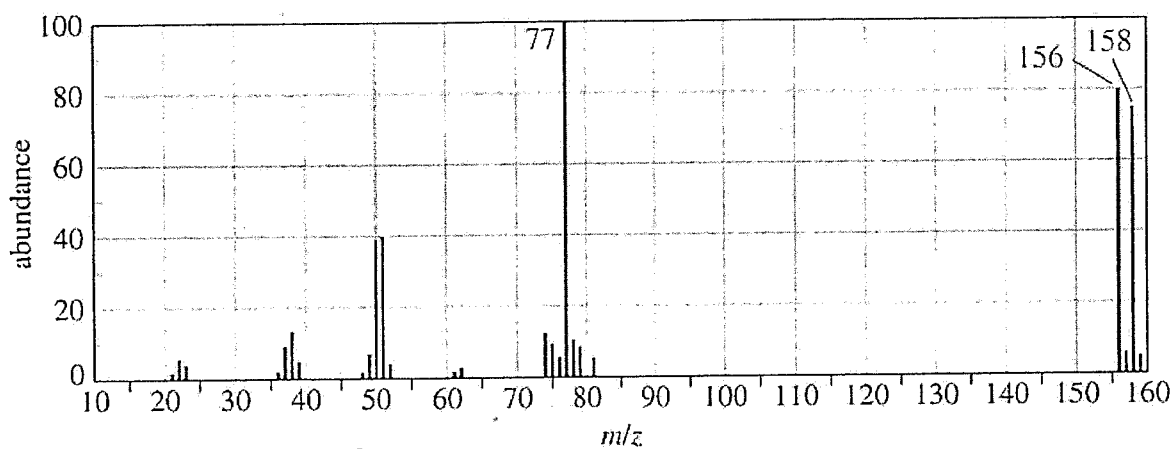
E).



In the given mass spectrum, the measured molecule has a halogen atom.

7. Which halogen is it? (2%) A). fluoride. B). chloride. C). bromide. D). iodide. E). astatide.

Please briefly explain. (3%)



This figure was adapted from Organic Chemistry (2017), Leroy G. Wade, Jr. and Jan William Simek, Pearson Education.