

45 長庚大學107學年度研究所碩士班招生考試試題

系所：生物醫學工程研究所碩士班

考試科目：有機化學

生化與生醫工程組

注意：請詳細閱讀下列試題，並請標明題號依試題順序將答案書寫於答案卷上。

本試題共 5 頁：第 1 頁

Part 1. Each questions or incomplete statements below is followed by suggested answers. Please select the best one in each case and write down the number in the corresponding space on the answer sheet. (2*20=40%)

1. Provide the reagents necessary to convert acetophenone to benzoic acid.

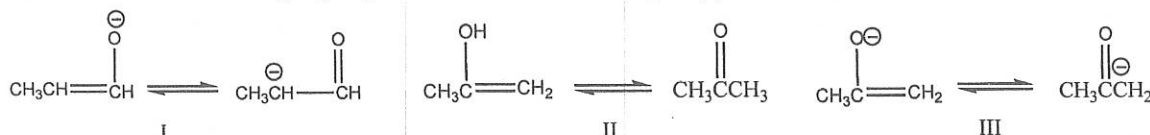
- A) $K_2Cr_2O_7/H_2SO_4/H_2O$ B) 1. $NaOH/Br_2$ 2. H_3O^+ C) 1. $KMnO_4/NaOH/H_2O$
D) 1. Br_2/PBr_3 2. H_2O E) both A & C

2. Provide the reagents necessary to carry out the following conversion.



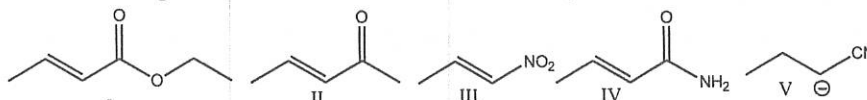
- A) 1. H_2O/H_2SO_4 , 2. PCC/CH_2Cl_2 B) PCC/CH_2Cl_2 C) 1. BH_3 , 2. $H_2O_2/NaOH/H_2O$
D) 1. O_3 , 2. $Zn/acetic\ acid$ E) 1. BH_3 , 2. $H_2O_2/NaOH/H_2O$, 3. PCC

3. Which of the following is(are) a keto-enol tautomeric pair(s)?



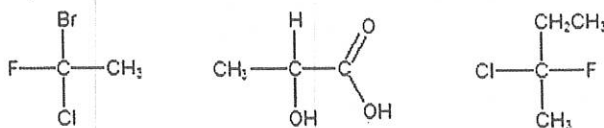
- A) I B) II C) III D) I & II E) I & III

4. Which one of the following is the most reactive Michael acceptor?



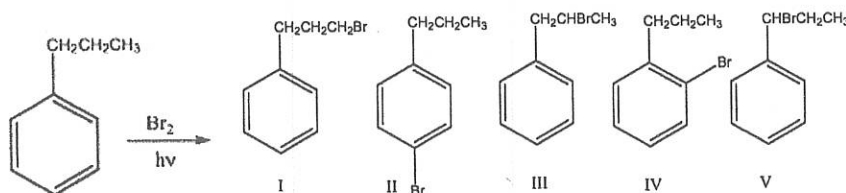
- A) I B) II C) III D) IV E) V

5. Identify the following compounds as *R* or *S*.



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

6. Provide the structure of the major product(s) for the following reaction.



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

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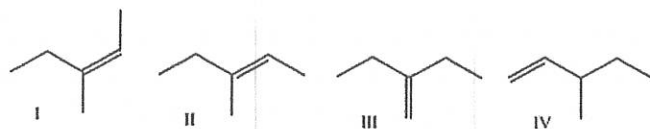
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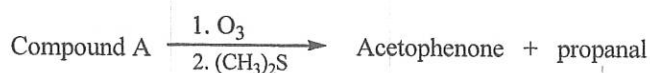
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7. Which of the following alkenes yield(s) 3-bromo-3-methylpentane as the major product upon addition of HBr?



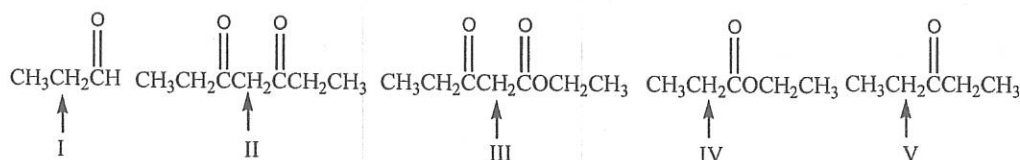
- A) I and II only B) III only C) I, II, and III only D) all of them E) none of them

8. Compound A on ozonolysis yields acetophenone and propanal. What is the structure of compound A?



- A) 2-phenyl-2-pentene B) 1-phenyl-1-hexene C) 1-phenyl-2-pentene D) 2-phenyl-2-hexene

9. Which are the most acidic α -hydrogens in the following compounds?



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

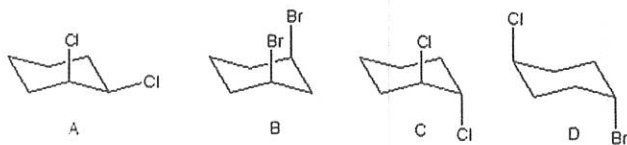
10. Which one of the following compound does not undergo an aldol addition reaction in presence of aqueous sodium hydroxide?

- A) butanal B) 2-methylbutanal C) 3-methylpentanal D) 2,2-dimethylbutanal E) none of these

11. Which of the following methods of preparation of amines can be used to prepare primary, secondary, and tertiary amines?

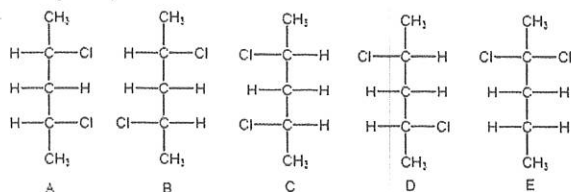
- A) Gabriel synthesis from an alkyl halide B) reduction amination of a ketone
C) Hofman rearrangement of an amide D) reduction of a nitrile
E) None of these methods is applicable to all types of amines

12. Identify the compounds that are not chiral.



- A) A, B, C B) B, C, D C) A, B, D D) A, C, D E) all of them

13. Identify all pairs of enantiomers



- A) B and D, A and C B) A and C C) B and D D) A and B, A and D, B and C, C and D
E) B and D, A and B, A and D, B and C, C and D

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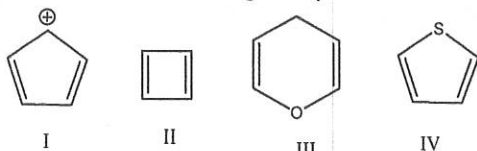
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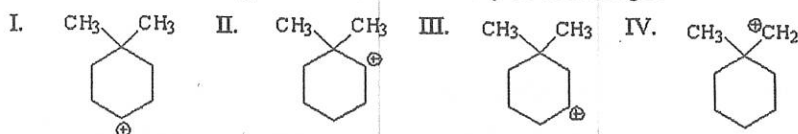
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14. Which one of the following compound is aromatic?



A) I B) II C) III D) IV E) none of these

15. Which of the following carbocations is likely to rearrange?



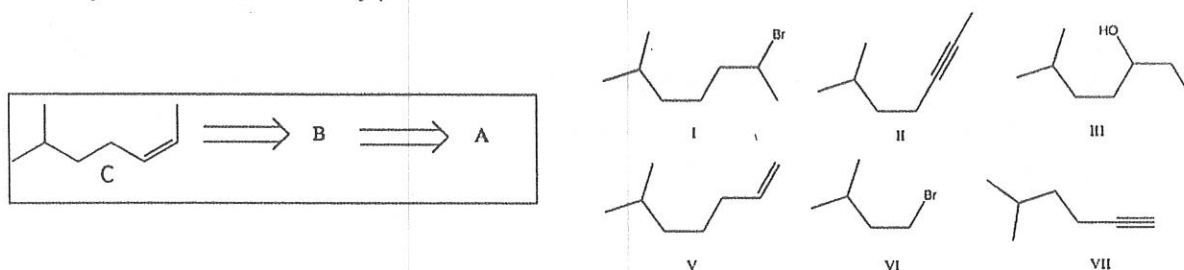
A) I B) II C) III D) IV E) II and IV

16. When 1-pentanol is heated with HCl/ZnCl_2 , 1-chloropentane is the major organic product.

This reaction proceeds through an _____ mechanism, and _____ is produced as a byproduct.

A) $\text{S}_{\text{N}}1$, H_2O B) $\text{S}_{\text{N}}2$, H_2O C) $\text{S}_{\text{N}}1$, H_2 D) $\text{S}_{\text{N}}2$, H_2 E) $\text{E}2$, H_2

17. Show that you understand the concept of retrosynthetic analysis by working backwards two steps in the synthesis below. Identify possible combinations of A and B that can lead to the alkene C:



A) B = I; A = V B) B = II; A = VII C) B = III; A = I D) B = I; A = VII E) B = II; A = VI

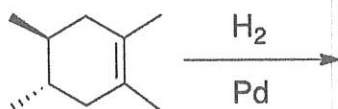
18. When a ketone is treated with LiAlH_4 followed by addition of H_2O , what general class of product results?

A) primary alcohol B) secondary alcohol C) tertiary alcohol D) ether E) aldehyde

19. _____ is produced when 1 equivalent of HBr is added to 1-hexyne.

A) 2-bromo-1-hexene B) *E*-1-bromo-1-hexene C) *Z*-1-bromo-1-hexene
D) A mixture of *E* and *Z* isomers of 1-bromo-1-hexene E) *E*-2-bromo-2-hexene

20. Hydrogenation of the following compound generates:



A) constitutional isomers. B) identical compounds. C) enantiomers.
D) diastereomers. E) meso compounds.

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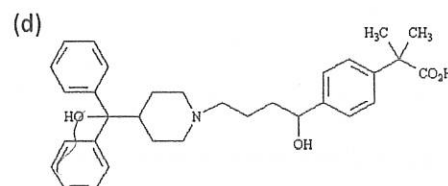
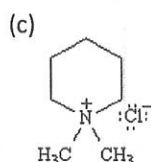
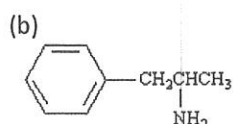
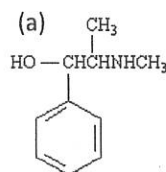
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本試題共 5 頁：第 4 頁

Part 2. Answer the following questions briefly. (60%)

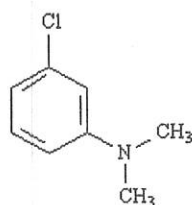
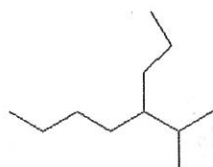
1. Classify each of the following nitrogen atoms in the following compounds as primary, secondary, tertiary, or quaternary. (8%)



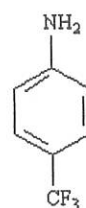
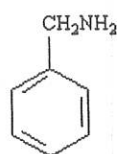
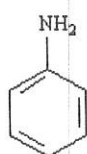
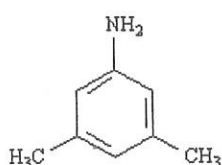
2. Draw structures corresponding to each of the given names. (8%)

- (a) p-methoxyaniline (b) 2,3-dimethyl-2-octen-4-one (c) 7-bromo-1-octyn-4-one
(d) (S)-3-chlorocyclohexanone

3. Provide proper IUPAC names. (6%)

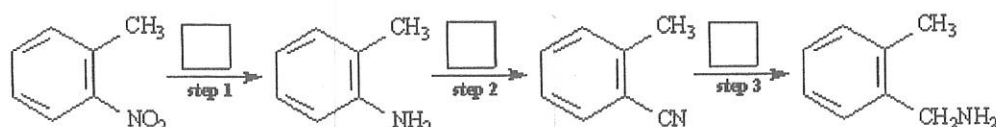


4. Rank the following compounds in order of increasing basicity. Label the least basic compound "1" and the most basic compound "4". Place the number corresponding to the compound's rank in the blank below the compound. (4%)



5. From the list provided below, choose the best reagent(s) for each step in the following synthesis. There is only one answer for each reaction. (6%)

- (a) NaBH₄, ethanol (b) KCN, acetone (c) 1. LiAlH₄, THF; 2. H₂O
(d) 1. HNO₂, H₂SO₄; 2. CuCN, KCN (e) 1. SnCl₂, H₃O⁺; 2. NaOH, H₂O (f) HNO₃, H₂SO₄



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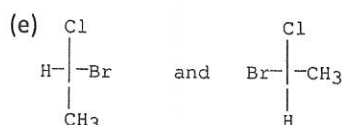
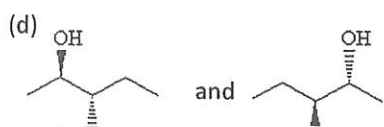
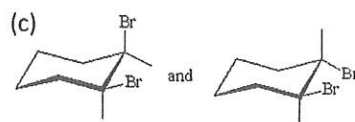
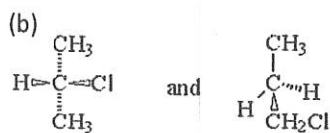
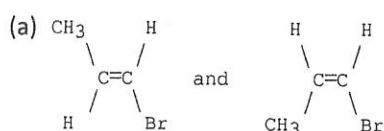
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6. What is the relationship between the following compounds?

Enantiomers or diastereomers or configurational isomers or identical compounds or constitutional isomers (10%)

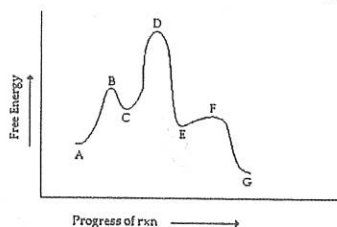


7. Consider the reaction coordinate diagram shown. (3%)

(a) Which step has the greatest activation energy?

(b) Which step has the greatest rate constant in the forward direction?

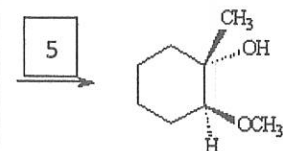
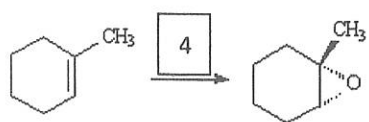
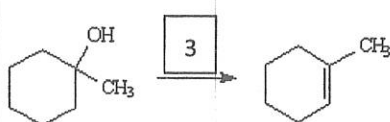
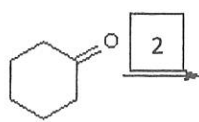
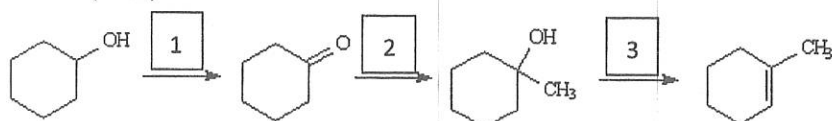
(c) What is the rate-determining step in the conversion of A to G?



8. Draw all likely products of the following reaction and circle the product you expect to predominate. (5%)



9. Choose the best reagent for carrying out the following reactions from the list below. Place the letter of the reagent(s) in the number box over the reaction arrow. Use only one letter per box. (10%)



(A) NaH, then CH_3I

(B) NaOCH_3 , CH_3OH

(C) $m\text{-ClC}_6\text{H}_4\text{CO}_3\text{H}$

(D) CH_3MgBr in ether, then H_3O^+

(E) warm $\text{H}_2\text{SO}_4/\text{H}_2\text{O}$

(F) $\text{Hg}(\text{O}_2\text{CCF}_3)_2$, CH_3OH

(G) H_2/Pd

(H) PCC, CH_2Cl_2

(I) Cl_2 , H_2O

(J) LiAlH_4 in ether, then H_3O^+