國　立　清　華　大　學　命　題　紙

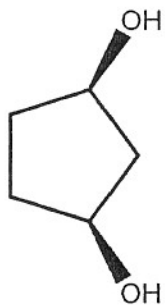
96 學年度 生醫工程與環境科學系 （所）甲（分子生醫光電）組 碩士班入學考試

科目 有機化學 科目代碼 2504 共 4 頁第 1 頁 *請在【答案卷卡】內作答

總分 100 分；共 25 題；考試時間 100 分鐘

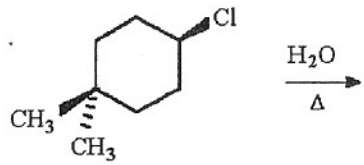
第一部分 選擇題 (No. 1-5)
單選 每題3分 共15分

1) How many enantiomers are there of the molecule shown below?



A) 6　　B) 1　　C) 0　　D) 2　　E) 3

2) Predict the most likely mechanism for the reaction shown below.



A) E1　　B) E2　　C) S_N1　　D) S_N2　　E) E1cb

3) Which of the following alcohols undergoes dehydration upon heating with concentrated H_2SO_4 without carbocation rearrangement?

A) 2-methylhexan-3-ol

B) 2-methyl-2-phenylpropan-1-ol

C) 3-methylpentan-3-ol

D) 3,3-dimethylpentan-2-ol

E) both A and B

4) Which of the following reagents is the best choice for oxidizing a primary alcohol to an aldehyde?

A) H_2CrO_4

B) pyridinium chlorochromate

C) $Na_2Cr_2O_7$, H_2SO_4

D) $KMnO_4$

E) $LiAlH_4$

5) _____ is produced when 1 equivalent of HBr is added to hex-1-yne in the presence of peroxides.

A) Z-1-Bromohex-1-ene

B) 2-Bromohex-1-ene

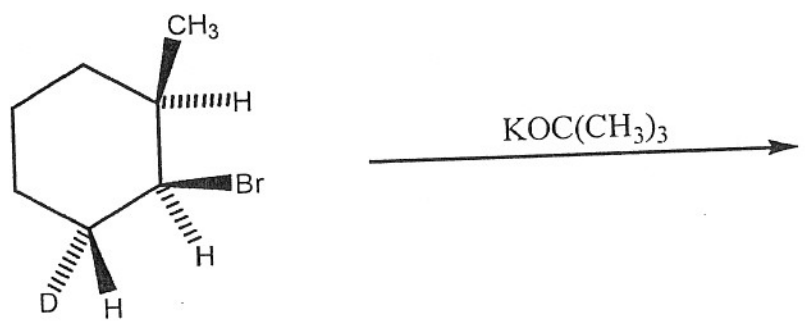
C) *E*-1-Bromohex-1-ene

D) A mixture of E and Z isomers of 1-bromohex-1-ene

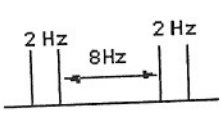
E) *E*-2-Bromohex-2-ene

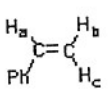
第二部分 非選擇題 (No. 6-24)
共85分

6) Provide the structure of the major organic product of the reaction below. (3 pts)



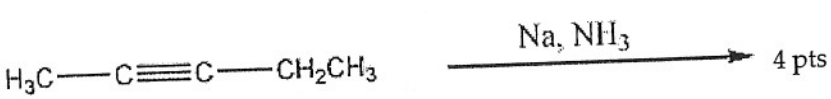
7) The following splitting pattern represents one of the vinyl protons of styrene. Identify which proton is represented and list all the coupling constants (J values) for the splitting pattern. (6 pts)





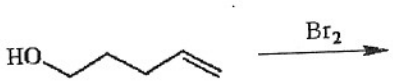
8) Provide the structure of 4-isopropylbenzaldehyde. 2 pts

9) Provide the structure of the major organic product(s) in the reaction below.

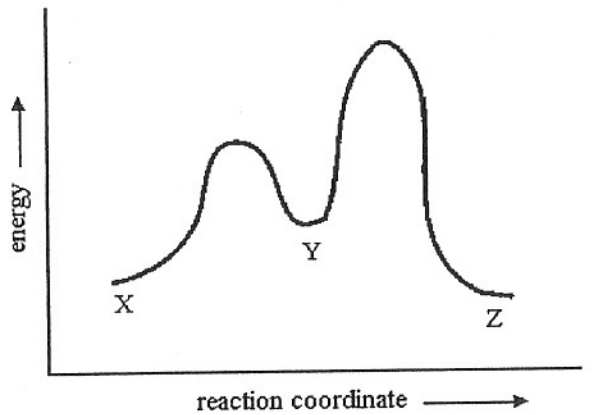


4 pts

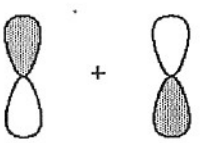
10) Provide a detailed, step-by-step mechanism for the reaction shown below. 5 pts



11) Consider the conversion of X to Z through the sole intermediate Y. Given the reaction-energy diagram shown below, which step is the rate-limiting step? Explain your reasoning. 3 pts



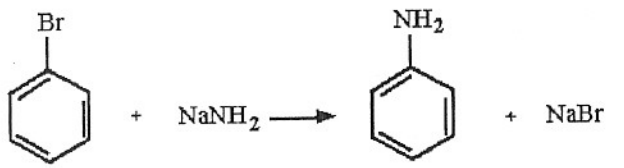
12) What kind of molecular orbital (σ, σ^*, π, or π^*) results when the two atomic orbitals shown below interact in the manner indicated?3 pts



13) Provide a detailed, stepwise mechanism for the acid-catalyzed transesterification of ethyl acetate with *n*-propanol. 6 pts

14) Provide a detailed, stepwise mechanism for the acid-catalyzed condensation reaction between cyclohexanone and H_2NOH. 6 pts

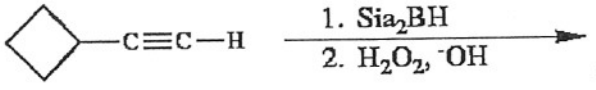
15) Provide a detailed, stepwise mechanism for the following reaction. 8 pts



16) Consider the possible thermal [4+4] cycloaddition of two molecules of 1,3-butadiene to generate cycloocta-1,5-diene. Show the HOMO/LUMO interaction which would result, and use this interaction to predict whether the proposed cycloaddition could occur. 5 pts

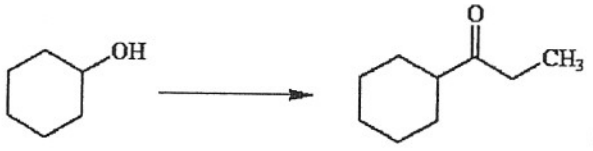
17) Explain why phenol is about 10^6 times more acidic than methanol. Use appropriate resonance structures as part of your explanation. 4 pts

18) Provide the structure of the major organic product(s) in the reaction sequence below.



4 pts

19) What series of synthetic steps could be used to carry out the transformation shown below?

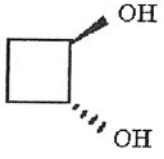


8 pts

20) List the following compounds in order of increasing reactivity in an S_N1 reaction. 3 pts

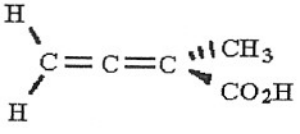
CH_3Br, $CH_3CH_2CH_2I$, $(CH_3)_3CI$, $CH_3CHBrCH_3$, CH_3CHICH_3

21) Is the molecule shown below chiral or achiral? 3 pts



22) Describe a sequence of reactions by which meso-2,3-dibromobutane can be straightforwardly prepared from propyne. 6 pts

23) Is the molecule shown below chiral or achiral? 3 pts



24) Which of the following terms best describes the pair of compounds shown: enantiomers, diastereomers, or the same compound? 3 pts