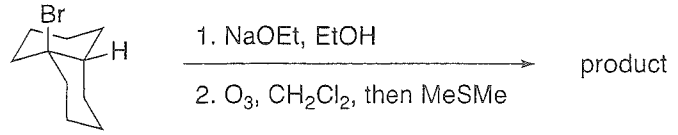
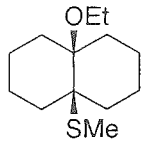
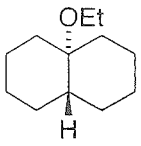
選擇題(選擇題請在答案卡上作答)

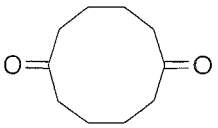
單選題(計有 40 題, 每題 2.5 分)：　不倒扣

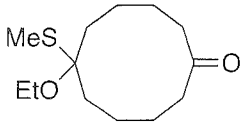
1. What is the expected major product of this sequence of reactions?

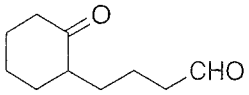


A) 

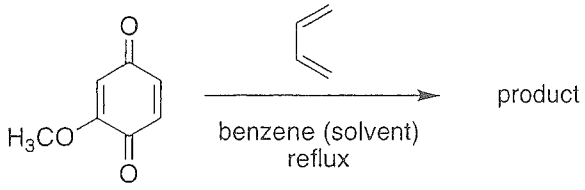
B) 

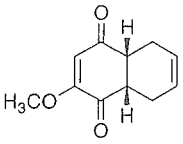
C) 

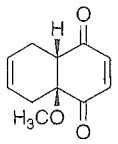
D) 

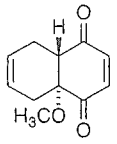
E) 

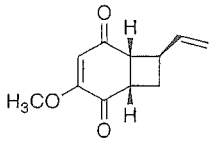
2. Identify the major product of the following reaction.

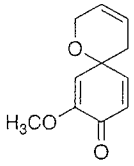


A) 

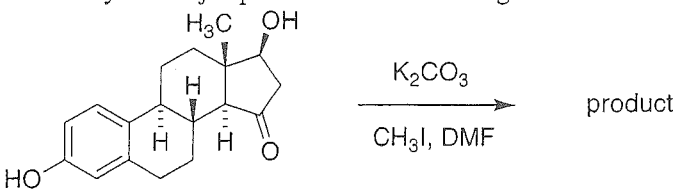
B) 

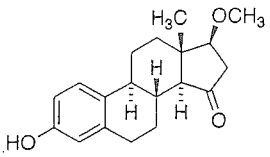
C) 

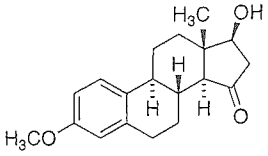
D) 

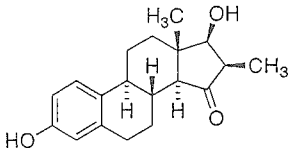
E) 

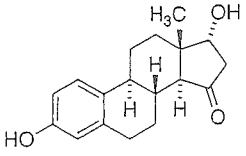
3. Identify the major product of the following reaction.

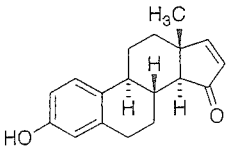


A) 

B) 

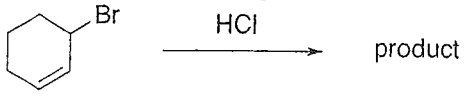
C) 

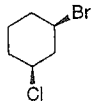
D) 

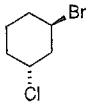
E) 

注意：背面有試題

4. The expected major product of HCl addition to the alkene would be:



A) 

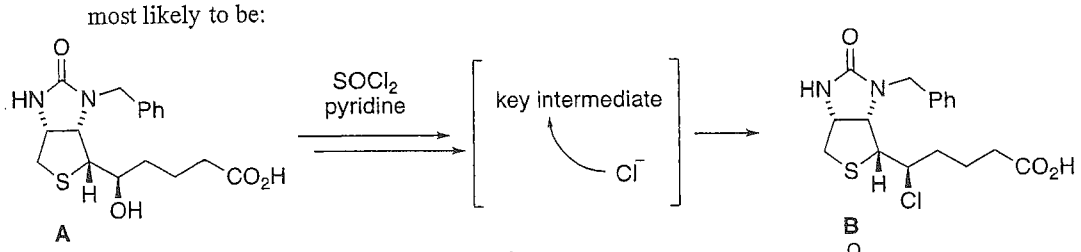
B) 

C) 

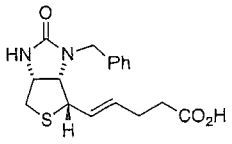
D) 

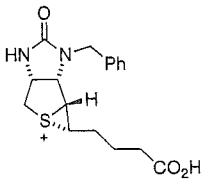
E) 

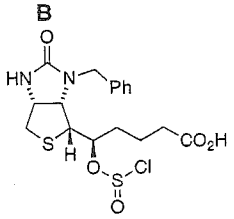
5. In the following substitution reaction, compound **A** was converted to compound **B** in excellent diastereoselectivity. After analyzing the stereochemcal relationship between **A** and **B**, it was proposed that chloride attacked a key intermediate, resulting in the formation of **B**. The structure of the key intermediate is most likely to be:

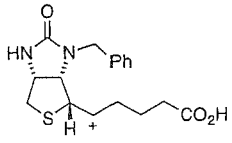


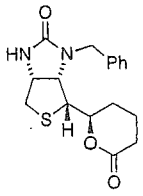
A　　B

A) 

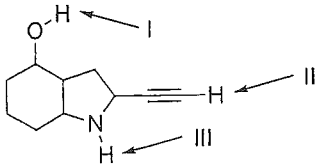
B) 

C) 

D) 

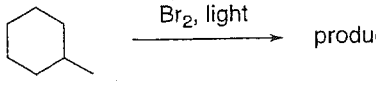
E) 

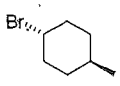
6. Rank the following protons (I, II, and III) in decreasing order (most to least) of acidity.

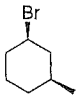


A) II>III>I
B) I>II>III
C) III>I>II
D) III>II>I
E) I>III>II

7. The light-induced bromination of the C–H bond of alkanes with molecular bromine could be a regioselective process. The reactions involved the formation of radical intermediates. Identify the major product of the following reaction.

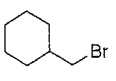


A) 

B) 

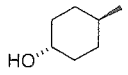
C) 

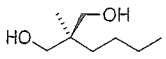
D) 

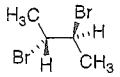
E) 

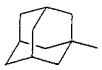
注意：背面有試題

8. Which of the following compounds is chiral?

A) 

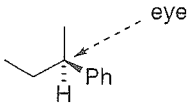
B) 

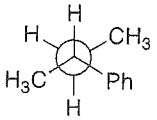
C) 

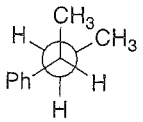
D) 

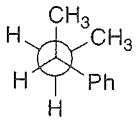
E) 

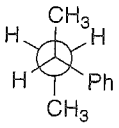
9. As viewed from the angle indicated, draw the Newman projection of the conformer of the following compound where the two methyl groups are *gauche*.

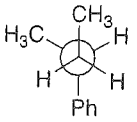


A) 

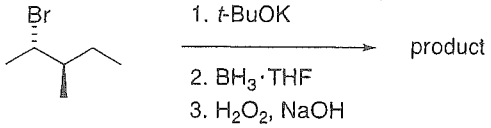
B) 

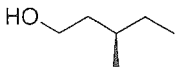
C) 

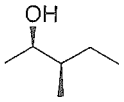
D) 

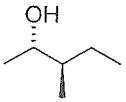
E) 

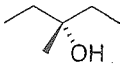
10. For the following reaction sequence, which molecule is expected as the major product?

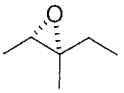


A) 

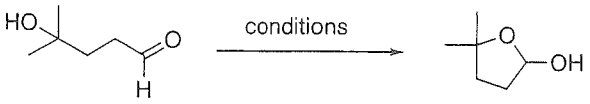
B) 

C) 

D) 

E) 

11. Examine the transformation shown below and then indicate which of the following statements is correct.



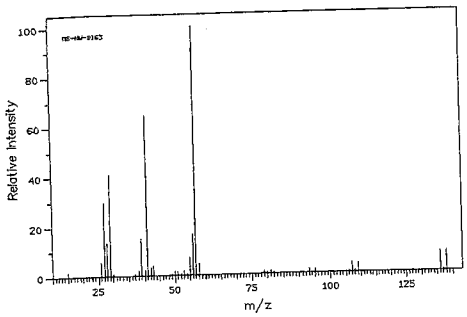
A) This is a reduction reaction.
B) The product is a protected ester.
C) The product has two resonance structures.
D) The entropy of the reaction decreases.
E) The unsaturation numbers of the starting material and the product are different.

12. A professor wanted to invent a C–H oxidation reaction, in which *n*-pentane could be oxidized to give mono-hydroxy products without skeletal rearrangement. In theory, how many isomers could be produced in this transformation?

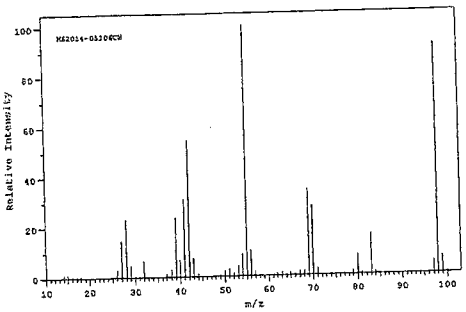
A) 3
B) 4
C) 5
D) 6
E) 7

注意：背面有試題

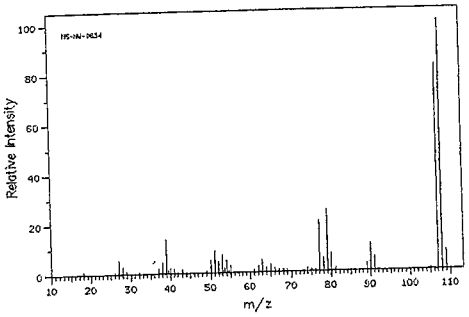
13. A graduate student found four reagent vials (I, II, III, IV) with unclear labels. A lab manager mentioned that one of the reagents could be chlorine-substituted alkane (R–Cl). The graduate student quickly made a judgment after collecting the mass spectra of these four samples. Based on the data, please tell us which vial contains a chloroalkane compound.



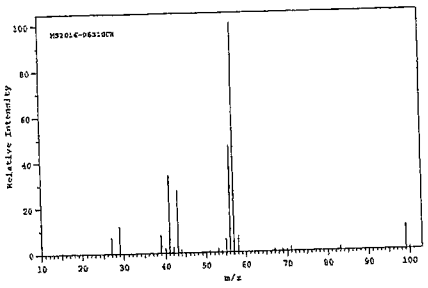
reagent vial I



reagent vial II



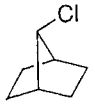
reagent vial III

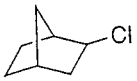


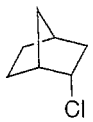
reagent vial IV

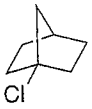
A) reagent vial I
B) reagent vial II
C) reagent vial III
D) reagent vial IV
E) None of them is a chlorine-substituted compound.

14. One of the following chloronorbornanes undergoes E2 elimination much faster than others. Considering the E2 mechanism and structural features of the norbornane systems, determine which one is faster to give the corresponding alkene product.

A) 

B) 

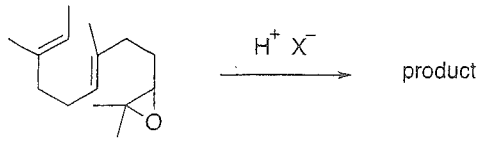
C) 

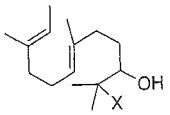
D) 

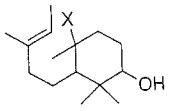
E) The above compounds react equally fast.

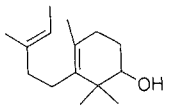
注意：背面有試題

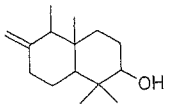
15. A student reported that an acid (H^+X^-) promoted a reaction of the epoxide to give a product. By analyzing the ^1H NMR spectrum of the product, the student saw that the most downfield peak is 3.4 ppm. Considering the reactivity of the epoxide and the spectroscopic data of the product, what is the most reasonable structure of the product?

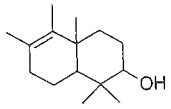


A) 

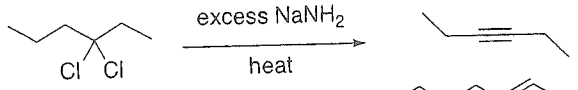
B) 

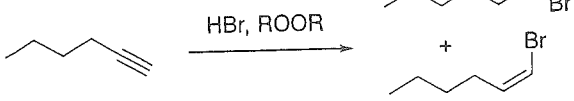
C) 

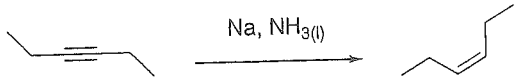
D) 

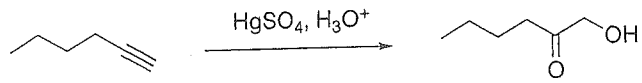
E) 

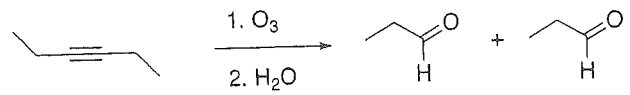
16. Based on your knowledge of current organic chemistry, which of the following reactions leads to a correct major product? Note: Only key reagents are shown, and assuming that appropriate workup procedures are applied.

A) 

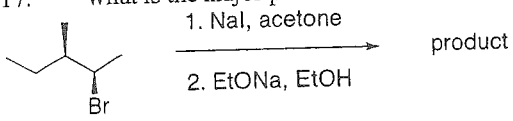
B) 

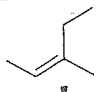
C) 

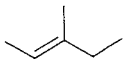
D) 

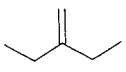
E) 

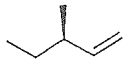
17. What is the major product for the following reaction?

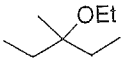


A) 

B) 

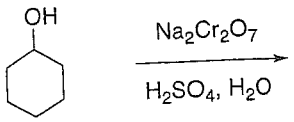
C) 

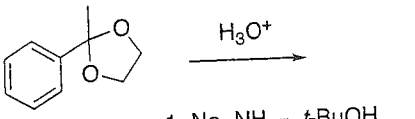
D) 

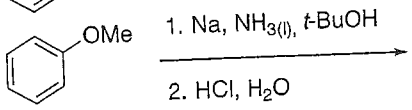
E) 

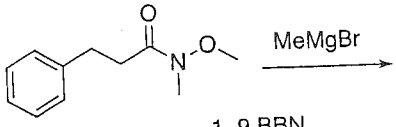
注意：背面有試題

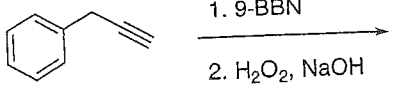
18. Which of the following reactions will NOT give a ketone as a major product?

A) 

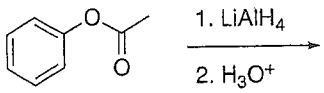
B) 

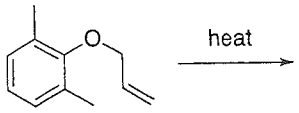
C) 

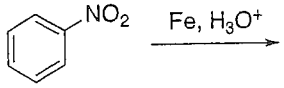
D) 

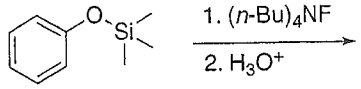
E) 

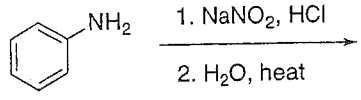
19. Which of these reactions will NOT give a phenol as a major product?

A) 

B) 

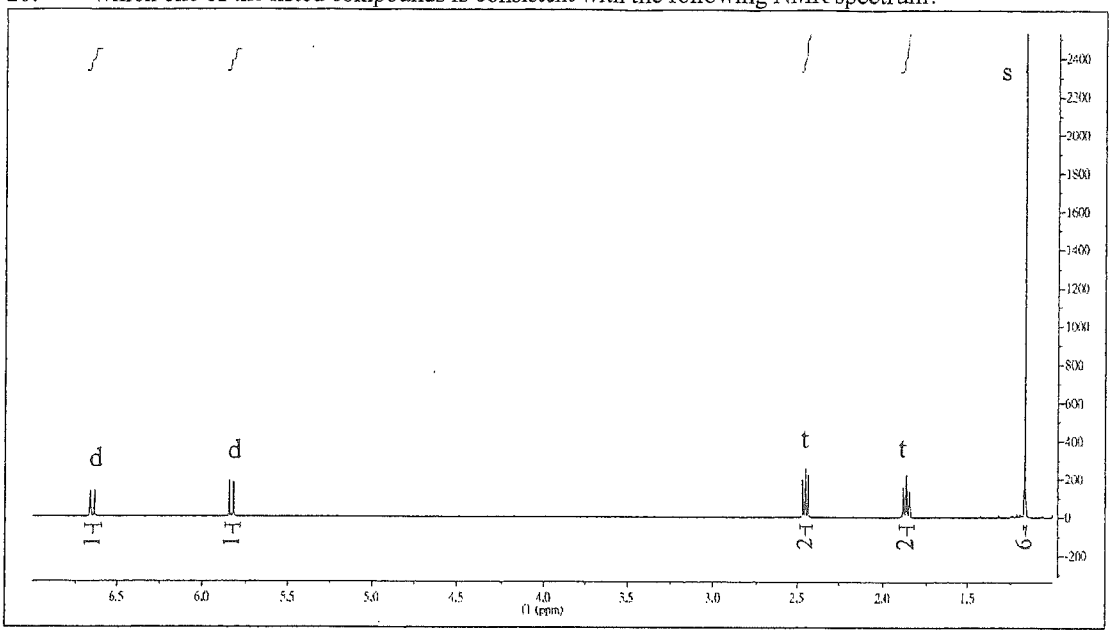
C) 

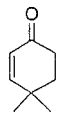
D) 

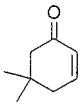
E) 

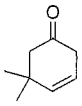
注意：背面有試題

20. Which one of the listed compounds is consistent with the following NMR spectrum?



A) 

B) 

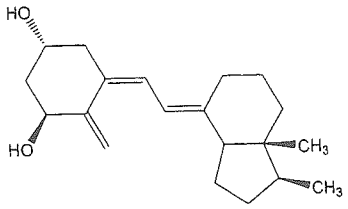
C) 

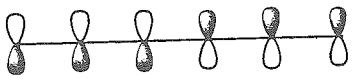
D) 

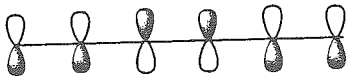
E) 

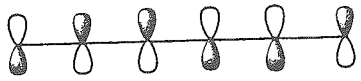
21. Which pair of reagents would produce the highest yield of (*R*)-2-ethoxybutane?
A) sodium (*S*)-2-butoxide + iodoethane
B) sodium (*R*)-2-butoxide + iodoethane
C) sodium ethoxide + (*S*)-2-iodobutane
D) sodium ethoxide + (*R*)-2-iodobutane
E) Both B and C would work equally well.

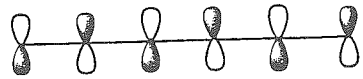
22. Which of the following represents the highest occupied molecular orbital for the conjugated pi system in Vitamin D_3?

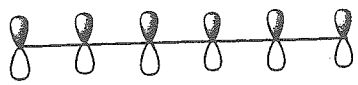


A) 

B) 

C) 

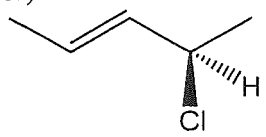
D) 

E) 

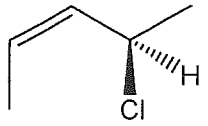
注意：背面有試題

23. When 1 mole of anhydrous HCl is reacted with excess 1,3-pentadiene, the 1,2 and the 1,4-addition products are formed. Which of the following structures below is the least likely to be one of these products? (Note: When a chiral carbon is formed in this reaction, a racemic mixture results, but only one of the two possible enantiomers is shown.)

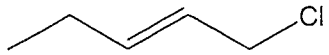
A)



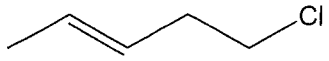
B)



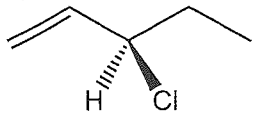
C)



D)



E)



24. Which of the following aromatic compounds will have the most significant number of signals in a ^{13}C NMR?

A) 1,4-Dimethylbenzene (*p*-methyl toluene)

B) 1,3,5-Trimethylbenzene (mesitylene)

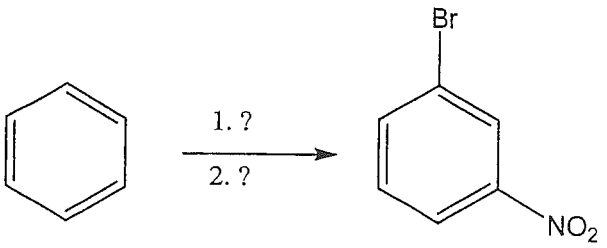
C) 1,2,4,5-Tetramethylbenzene

D) Methyl benzene (toluene)

E) 1, 2-Dimethyl benzene (*o*-methyl toluene)

25. Choose the *best* reagent(s) from the list below for the following conversions. Place the letter of the reagent in the box beside the reaction number over the arrow. There is only one answer for each reaction.

a. $KMnO_4$, H_3O^+
b. Br_2, $FeBr_3$
c. H_2/Pd
d. NBS, peroxides
e. HNO_3, H_2SO_4

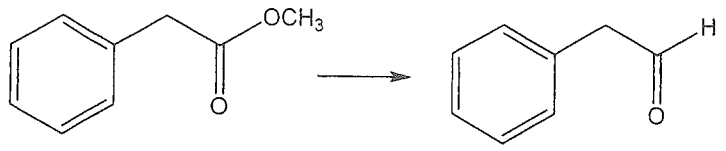


A) 1. e; 2. b
B) 1. b; 2. e
C) 1. a; 2. b
D) 1. d; 2. e
E) 1. b; 2. a

注意：背面有試題

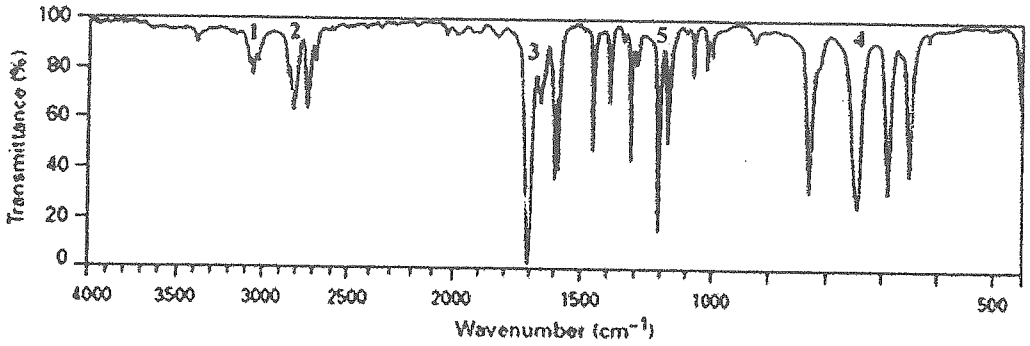
26. Which of the following could successfully undergo a Friedel-Crafts alkylation? Assume an appropriate catalyst is applied.
A) chlorobenzene reacting with benzene
B) 2-chloroethene reacting with 1-chloro benzene
C) 2-chlorobutane reacting with benzene
D) 2-chloropropane reacting with benzaldehyde
E) 1-chloroppropane reacting with 1-nitro benzene

27. Choose the **BEST** reagent for each of the following conversions.



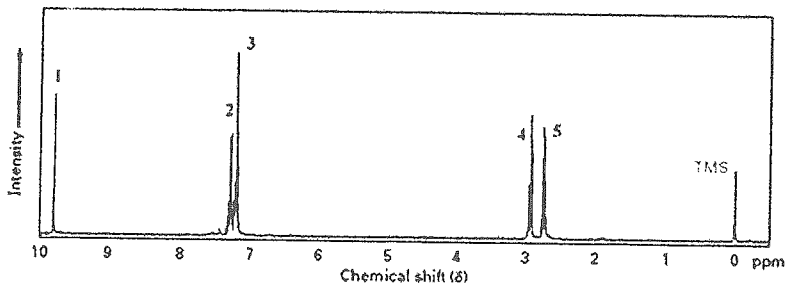
A) $LiAlH_4$, THF
B) $NaBH_4$, ethanol
C) 1. DIBAH, toluene
   2. H_3O^+
D) All of the above work well

28. Which labeled peaks would distinguish an aldehyde from a ketone based on this spectrum?



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

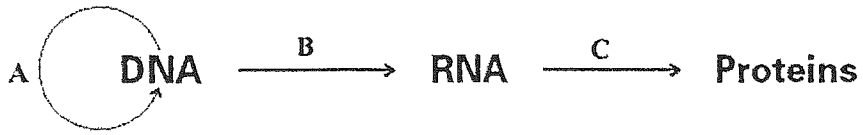
29. Which labeled peaks would distinguish an aldehyde from a ketone based on this spectrum?



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

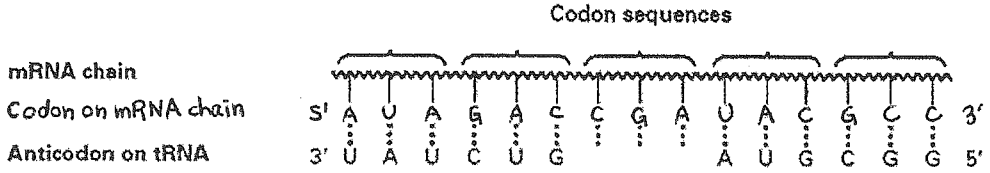
注意：背面有試題

30. In the diagram below, fill in the terms in the appropriate places indicated by a letter.



A) A - replication, B - transcription, C - translation
B) A - replication, B - translation, C - transcription
C) A - transcription, B - replication, C -translation
D) A - translation, B - transcription, C - replication
E) A - translation, B - transcription, C – replication

31. Consider the following diagram.



Which letter should be filled in on the bottom line?
A) GCU　B) UCG
C) GCT　D) TGC　E) GUC

32. Which of the following monomers is least readily polymerized under anionic polymerization conditions?
A) acrylonitrile
B) isobutylene
C) methyl acrylate
D) methyl α-cyanoacrylate
E) methyl α-methacrylate

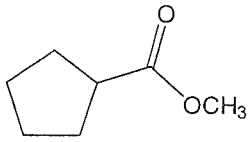
33. Which reagent below could best be used to distinguish $CH_3(CH_2)_{10}CO_2H$ from $CH_3(CH_2)_4CH{=}CH(CH_2)_4CO_2H$?
A) $NaOH, H_2O$
B) $Ag(NH_3)_2^+$
C) $H_2Cr_2O_7$
D) Br_2/CCl_4
E) NH_3

34. Which of the following will result in removing a benzyl protecting group of benzyl ester?
A) acid hydrolysis only
B) decarbonylation only
C) catalytic hydrogenation only
D) both acid hydrolysis and decarbonylation
E) both catalytic hydrogenation and acid hydrolysis

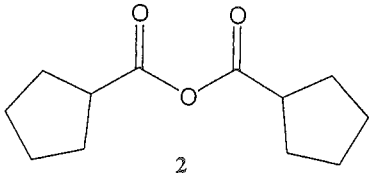
注意：背面有試題

35. Which of the following is a nucleophile that does conjugate additions?
A) CH_2=CHCHO
B) CH_2=CHCN
C) CH_2=$CHCO_2CH_3$
D) CH_3CH_2MgBr
E) $(CH_3)_2CuLi$

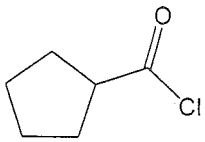
36. Arrange the carboxylic acid derivatives below to increase reactivity towards nucleophilic acyl substitution.



1



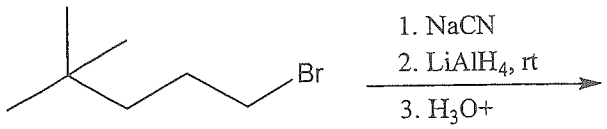
2



3

A) 1 < 2 <3
B) 1 < 3 < 2
C) 2 < 1 < 3
D) 2 < 3 < 1
E) 3 < 2 < 1

37. What is the product of the following reaction?



A) $(CH_3)_3CCH_2CH_2CH_2COOH$
B) $(CH_3)_3CCH_2CH_2CH_2NH_2$
C) $(CH_3)_3CCH_2CH_2CH_2CH_2NH_2$
D) $(CH_3)_3CCH_2CH_2CH_2CONH_2$
E) (CH3)3CCH2CH2CH2CH=NH

38. An ether solution of $PhCO_2H$ (A), $PhNH_2$ (B), and $PhCH_3$ (C) is extracted with aqueous NaOH. What compound(s) will the ether layer contain after the extraction?
A) A + B
B) A + C
C) B + C
D) A + B + C
E) A only

39. Which of the following amines is the most robust base?
A) cyclohexylamine
B) pyrrole
C) *p*-iodoaniline
D) piperidine
E) imidazole

40. Which of the following is an incorrect description of benzene?
A) The CCC bond angles are all equal to 120°.
B) The molecule is planar.
C) The molecule is a 6-membered ring that contains alternating single and double carbon-carbon bonds.
D) The molecule is aromatic.
E) The molecule can be drawn as a resonance hybrid of two Kekulé structures.