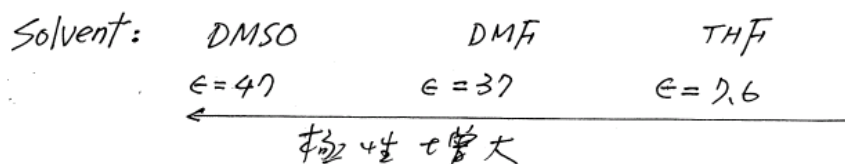
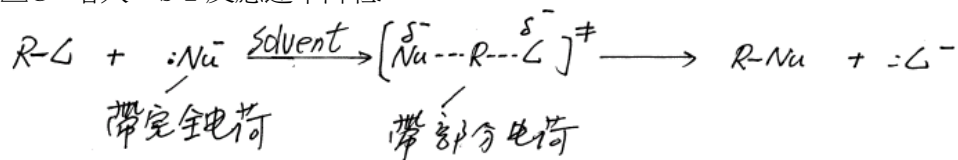


《化學》 試題解析

爭議試題

一、第 2 題：

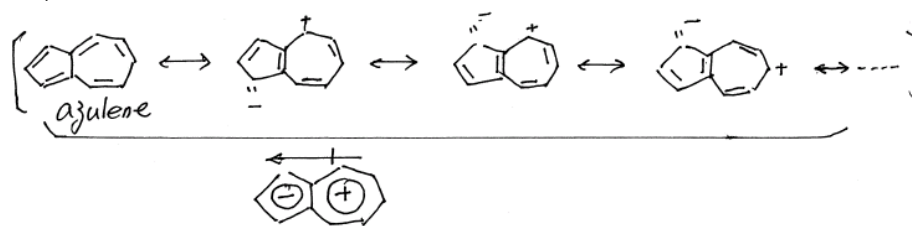
在 S_N2 反應，若是親核劑有帶電荷，最好使用極性非質子溶劑(polar aprotic solvent)，因為極性非質子溶劑會用 ion-dipole 作用力 Solvated cations 使陰離子親核劑更具親核性。但是，使用極性愈大的非質子溶劑，溶劑穩定化反應物比穩定化 Transition state 大， ΔG^\ddagger 增大， S_N2 反應速率降低。



此答案應為(C)

詳見 Organic Chemistry, Bruice, 5ed, P.375~377

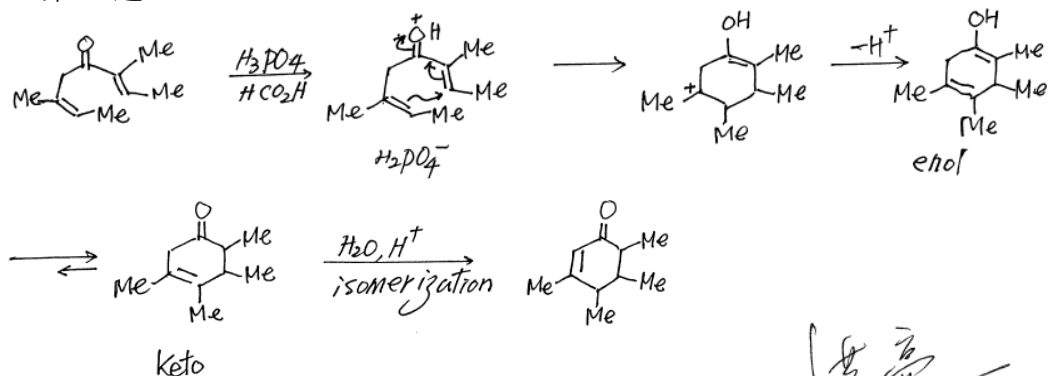
二、第 12 題：



Aromatic, 極性碳氫化合物

此答案應為(A)

三、第 72 題：



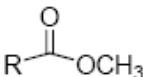
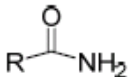
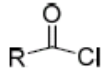
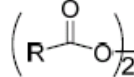
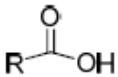
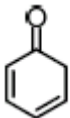
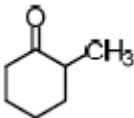
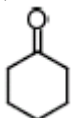
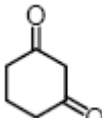
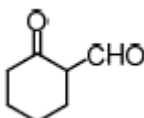

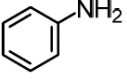


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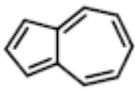
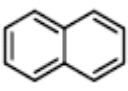
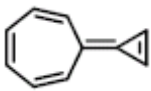
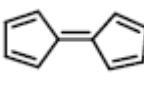

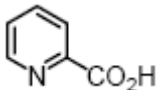
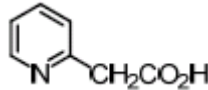
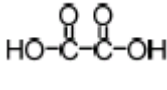
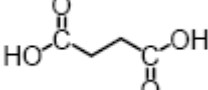
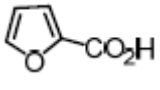
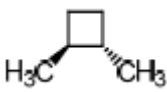
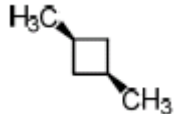
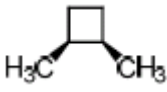
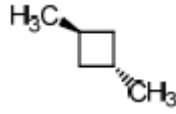

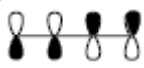
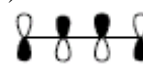
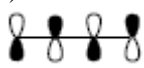
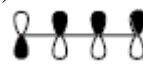

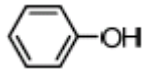
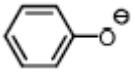
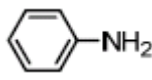
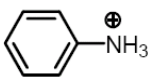
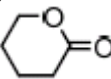
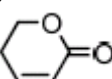
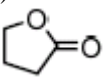
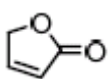
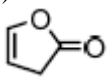

此答案應為(A)

《化學》

I. Choose one correct answer for the following questions

【單選題】每題 1 分，共計 60 分，答錯 1 題倒扣 0.25 分，倒扣至本大題零分為止，未作答，不給分亦不扣分。

- (E) 1. About the ionic liquids, which statement is **true**?
 (A) They dissolve both polar and nonpolar organic compounds.
 (B) They are nonflammable. (C) They are thermally stable.
 (D) They do not evaporate. (E) All in the above.
- (C) 2. When an S_N2 reaction was carried out, under which of the following solvents would you expect acetate ion (CH_3CO_2^-) to be the most reactive nucleophile?
 (A) DMSO (B) DMF (C) THF (D) CH_3OH (E) H_2O
- (C) 3. What is the energy difference in kcal/mol between *cis*-1,2-dimethylcyclohexane and its *trans* isomer?
 (A) 0 (B) 0.9 (C) 1.8 (D) 2.7 (E) 3.6
- (A) 4. Dieldrin, $\text{C}_{12}\text{H}_8\text{C}_{16}\text{O}$, is a pentacyclic compound formerly used as an insecticide. How many double bonds does dieldrin have?
 (A) 1 (B) 2 (C) 3 (D) 4 (E) 5
- (D) 5. Which of the following is **not** a major peak in the Mass spectrum of isopentane?
 (A) 29 (B) 43 (C) 57 (D) 60 (E) 72
- (B) 6. Which of the following compounds is the least reactive toward nucleophilic acyl substitution?
 (A)  (B)  (C)  (D)  (E) 
- (A) 7. When compared to the keto form, the enol form of which of the following compounds is most stable?
 (A)  (B)  (C)  (D)  (E) 
- (C) 8. Among the butane conformers, which occur at energy minima on a graph of potential energy versus dihedral angle?
 (A) gauche only (B) eclipsed and totally eclipsed
 (C) gauche and anti (D) eclipsed only (E) anti only
- (E) 9. Rank the following amines in order of decreasing basicity.
 I  II  III  IV 
- (A) I > II > III > IV (B) II > I > III > IV (C) III > I > II > IV (D) IV > I > III > II (E) I > III > II > IV

- (D) 10. Which of the following compounds has the highest boiling point?
 (A) $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ (B) $\text{CH}_3\text{CO}_2\text{CH}_3$ (C) $\text{CH}_3\text{CH}_2\text{CO}_2\text{H}$
 (D) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CONH}_2$ (E) $\text{CH}_3\text{CH}_2\text{CN}$
- (C) 11. In the following alkanes, which one has the lowest strain energy?
 (A) cyclopropane (B) cyclobutane (C) cyclohexane (D) cycloheptane (E) cyclooctane
- (A) 12. Which of the following compounds has the greatest dipole moment?
 (A)  (B)  (C)  (D)  (E) 
- (B) 13. Which of the following acids has the greatest rate toward decarboxylation?
 (A)  (B)  (C)  (D)  (E) 
- (A) 14. Which of the following structures is chiral?
 (A)  (B)  (C)  (D)  (E) none of above
- (B) 15. Which of the following molecular orbitals is the HOMO of 1,3-butadiene in the ground state?
 (A)  (B)  (C)  (D)  (E) 
- (C) 16. Which of the following species has the greatest λ_{max} in the UV spectrum?
 (A)  (B)  (C)  (D)  (E) 
- (B) 17. Which of the following compounds absorbs the longest wavelength of UV-visible light?
 (A) (Z)-1,3-hexadiene (B) (E)-1,3,5-hexatriene (C) 1-hexene
 (D) (E)-2-butene (E) (Z)-2-butene
- (C) 18. Which of the following solvents is best used in IR spectrum?
 (A) water (B) ether (C) CCl_4 (D) THF (E) methanol
- (E) 19. Which of the following esters has the highest frequency of the C=O absorption?
 (A)  (B)  (C)  (D)  (E) 
- (B) 20. Using a 60 MHz spectrometer, a chemist observes the following absorption: doublet, $J = 7.0$ Hz, at δ 4.00. What would the chemical shift (δ) be in the 300 MHz spectrum?
 (A) 3.50 (B) 4.00 (C) 4.50 (D) 20.0 (E) 0.80
- (A) 21. How many types of nonequivalent protons of the following compounds are possible?


(A) 4

(B) 5

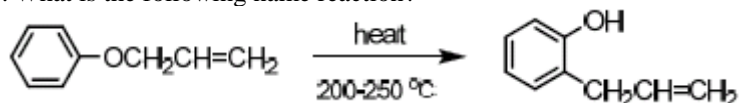
(C) 6

(D) 7

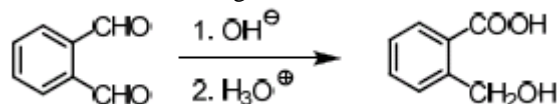
(E) 8

- (C) 22. The major type of reactions that alkanes undergo is:
 (A) electrophilic substitution reactions. (B) electrophilic addition reactions
 (C) free radical substitution reactions (D) free radical addition reactions
 (E) nucleophilic substitution reactions

- (C) 23. What is the following name reaction?



- (A) Friedel-Crafts alkylation (B) Friedel-Crafts allylation
 (C) Claisen rearrangement (D) Ritter reaction
 (E) Curtius rearrangement
- (B) 24. What is the following reaction?

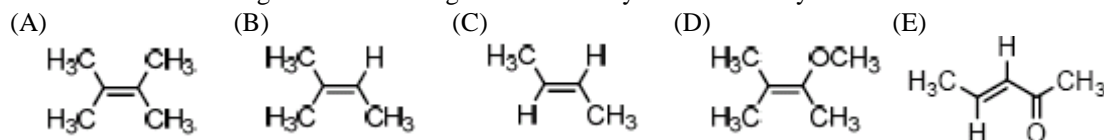


- (A) aldol condensation (B) Cannizzaro reaction
 (C) Claisen-Schmidt reaction (D) Knoevenagel reaction
 (E) Wittig reaction

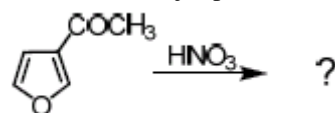
- (B) 25. What product will be given if indole is reacted with bromine at 0 °C in dioxane?

- (A) 2-bromoindole (B) 3-bromoindole (C) 4-bromoindole (D) 5-bromoindole (E) none of the above

- (D) 26. Which of the following alkenes has the greatest reactivity toward ozonolysis?

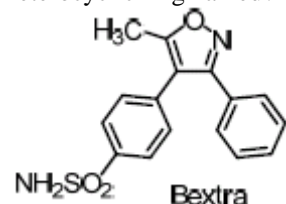


- (D) 27. What is the major product of the reaction shown below?



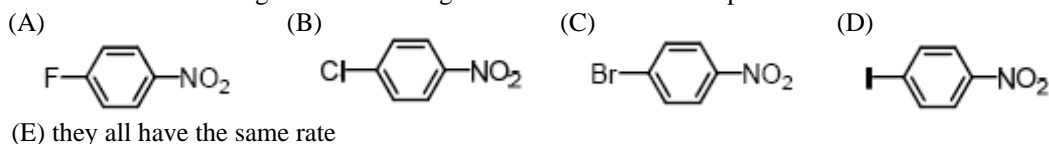
- (A) (B) (C) (D) (E) all of the above

- (C) 28. Bextra, a COX-2 inhibitor used in the treatment of arthritis, contains a heterocyclic ring. What is this heterocyclic ring named?

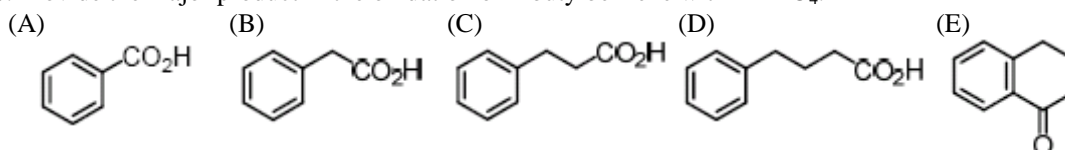


- (A) furan ring (B) oxazole ring (C) isoxazole ring (D) thiophene ring (E) indole ring

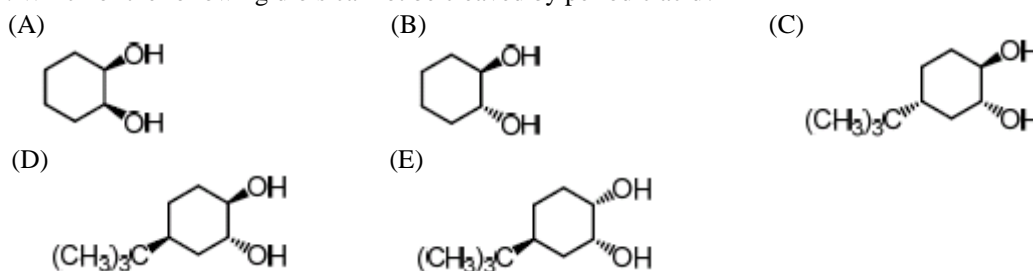
(A) 29. Which of the following halides has the greatest rate toward nucleophilic aromatic substitution?



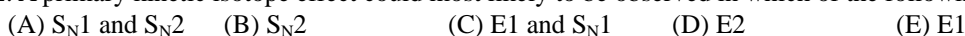
(A) 30. Provide the major product in the oxidation of n-butylbenzene with KMnO_4 .



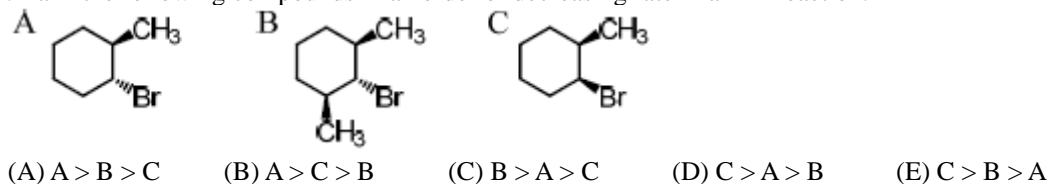
(D) 31. Which of the following diols cannot be cleaved by periodic acid?



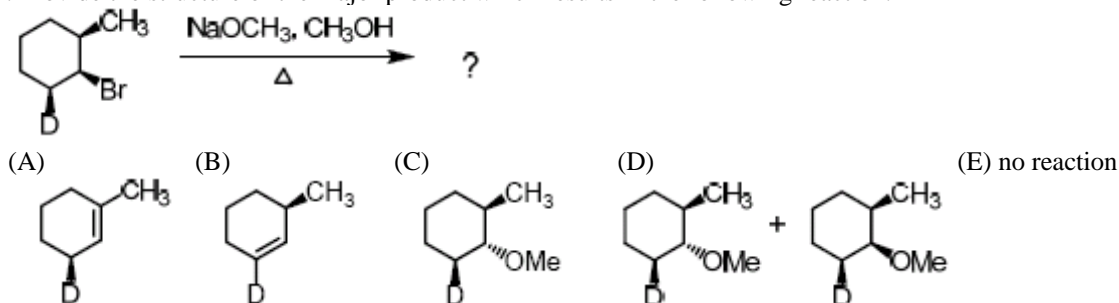
(D) 32. A primary kinetic isotope effect could most likely to be observed in which of the following mechanisms?



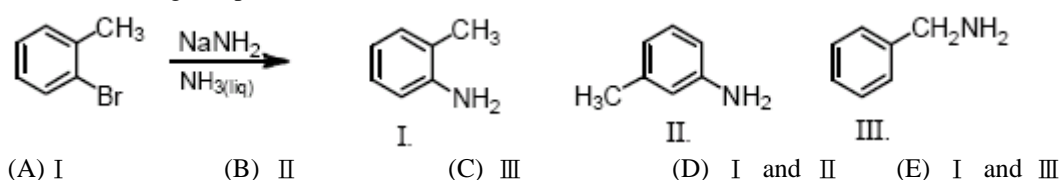
(D) 33. Rank the following compounds in an order of decreasing rate in an $\text{E}2$ reaction.



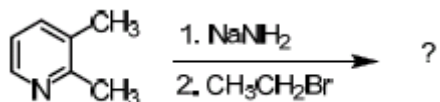
(A) 34. Provide the structure of the major product which results in the following reaction.



(D) 35. Provide the organic product(s) of the reaction shown below.

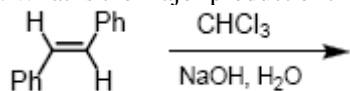


(E) 36. What is the major product of the following reaction?



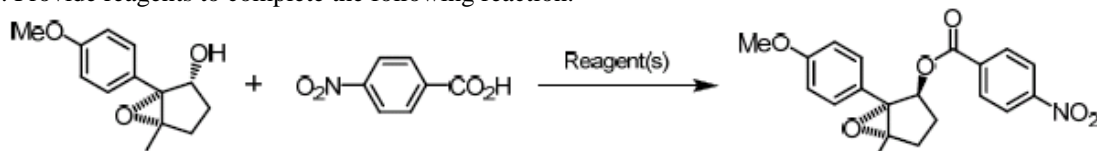
- (A) 4-ethyl-2,3-dimethyl-2-propylpyridine (B) 5-ethyl-2,3-dimethyl-2-propylpyridine
 (C) 6-ethyl-2,3-dimethyl-2-propylpyridine (D) 2-methyl-3-propylpyridine
 (E) 3-methyl-2-propylpyridine

(C) 37. What is the major product of the following reaction?



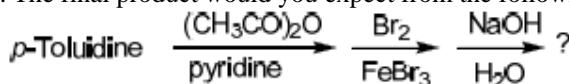
- (A) (B) (C) (D) (E) none of the above

(A) 38. Provide reagents to complete the following reaction.



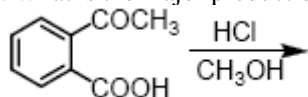
- (A) DEAD, PPh_3 (B) H_2SO_4 (C) NaOH
 (D) DMSO, oxalyl chloride (E) Bu_3SnH

(C) 39. The final product would you expect from the following sequential reactions from *p*-toluidine.



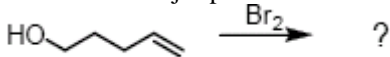
- (A) 2-bromo-3-methylaniline (B) 3-bromo-4-methylaniline
 (C) 2-bromo-4-methylaniline (D) 2-bromo-4-methylphenol
 (E) none of the above

(A) 40. What is the major product of the following reaction sequence?



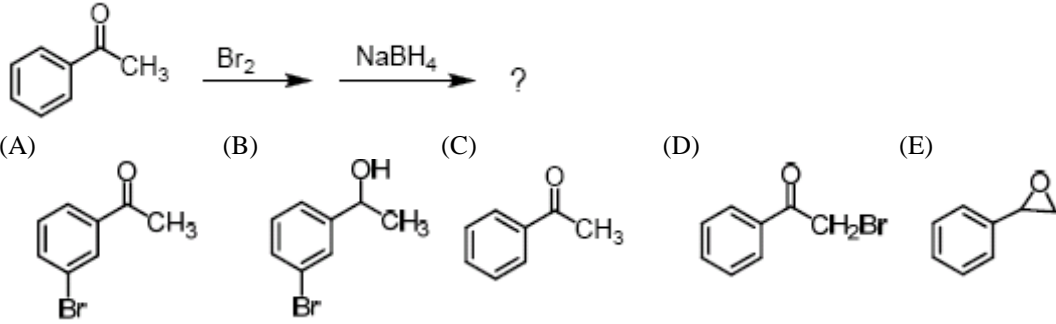
- (A) (B) (C) (D) (E)

(B) 41. What is the major product of the following reaction?

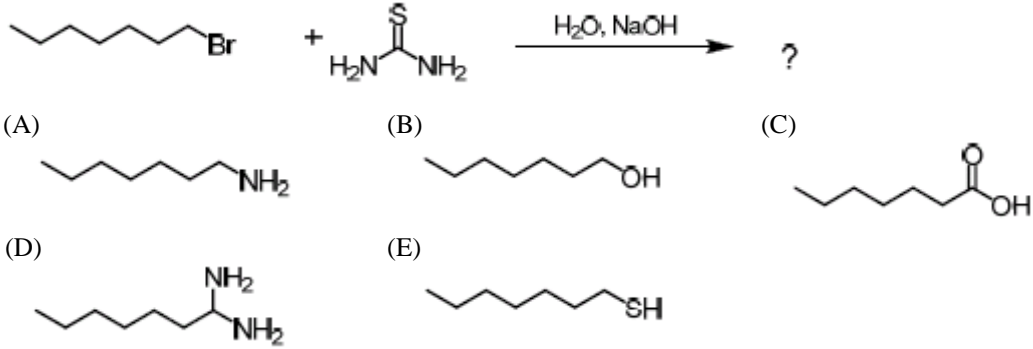


- (A) (B) (C) (D) (E)

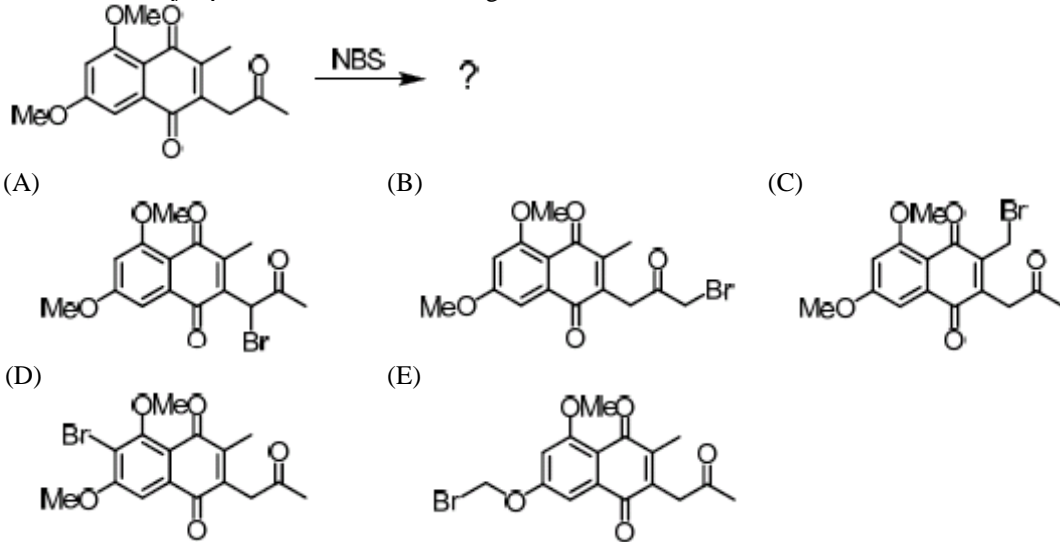
(E) 42. What is the major product of the following reaction?



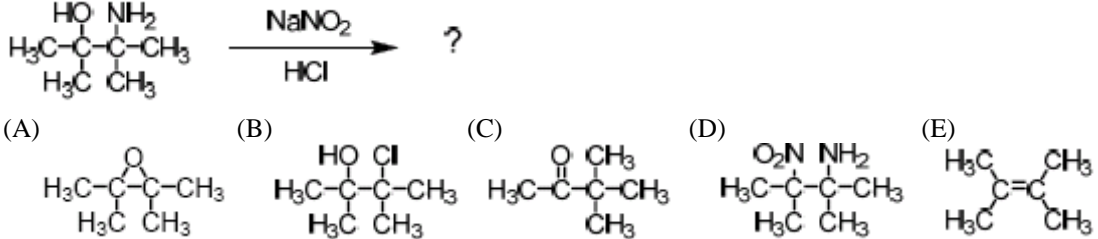
(E) 43. What is the major product of the following reaction?



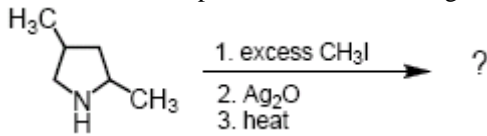
(C) 44. What is the major product from the following reaction?



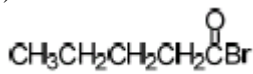
(C) 45. What product would be obtained from the following reaction?



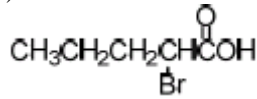
(C) 46. What will be the product of the following transformations?



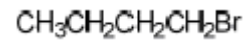
(A)



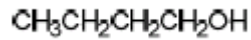
(B)



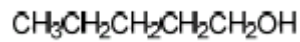
(C)



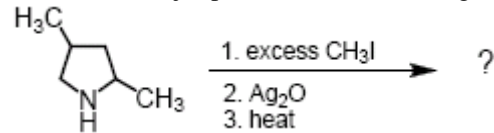
(D)



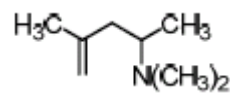
(E)



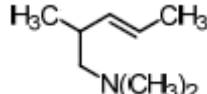
(C) 47. What is the major product of the following transformations?



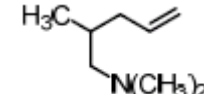
(A)



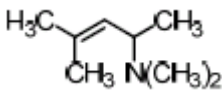
(B)



(C)

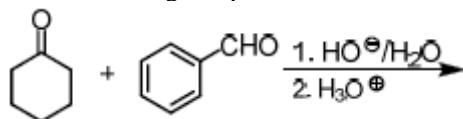


(D)

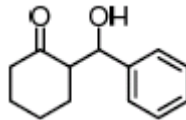


(E) none of the above

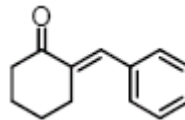
(B) 48. Provide the organic product of the reaction shown below.



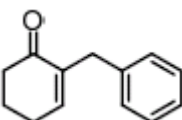
(A)



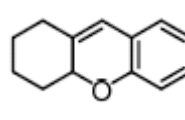
(B)



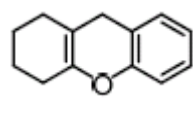
(C)



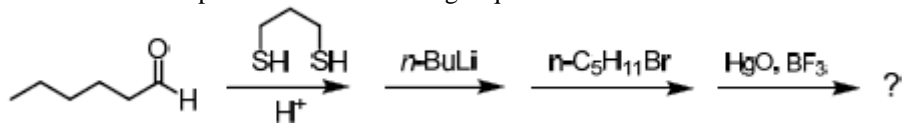
(D)



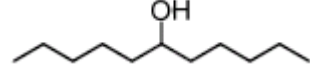
(E)



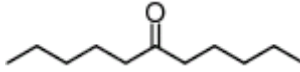
(B) 49. What is the final product of the following sequential reactions?



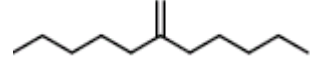
(A)



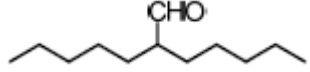
(B)



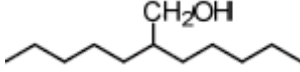
(C)



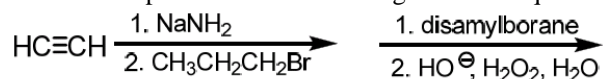
(D)



(E)

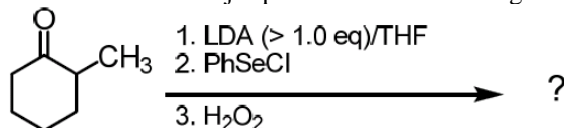


(C) 50. What is the product of the following reaction sequence?



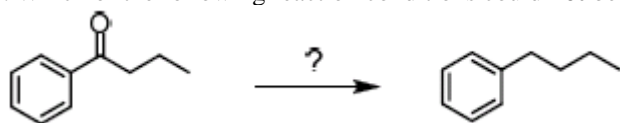
- (A) $\text{C}_3\text{H}_7\text{C}\equiv\text{CC}_3\text{H}_7$ (B) $\text{C}_3\text{H}_7\text{C}\equiv\text{CH}$ (C) $\text{C}_4\text{H}_9\text{CHO}$ (D) $\text{C}_3\text{H}_7\text{-}\overset{\text{OH}}{\underset{\text{H}}{\text{C}}}\text{-CH}_3$ (E) $\text{C}_4\text{H}_9\text{CH}_2\text{OH}$

(B) 51. What is the final major product of the following transformations?



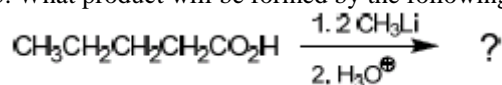
- (A)  (B)  (C)  (D)  (E) none of the above

(D) 52. Which of the following reaction conditions could **not** be used in the following transformation?



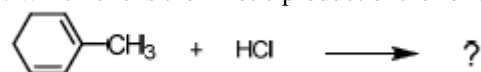
- (A) $\xrightarrow[10\% \text{ HCl, reflux}]{\text{Zn(Hg)}}$ (B) $\xrightarrow[\text{HOCH}_2\text{CH}_2\text{OH}]{\text{H}_2\text{NNH}_2, \text{NaOH}}$ (C) $\xrightarrow[2. \text{Raney-Ni, EtOH}]{1. \text{HS(CH}_2)_2\text{SH, BF}_3 \cdot \text{OEt}_2}$ (D) $\xrightarrow[\text{Et}_3\text{N, MeOH}]{\text{TiCl}_4}$
 (E) none of the above

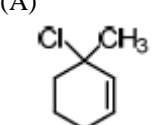
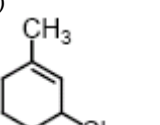
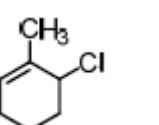
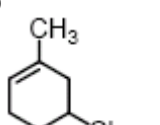
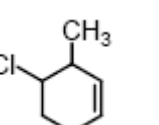
(C) 53. What product will be formed by the following reaction conditions?



- (A) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CO}_2\text{CH}_3$ (B) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\overset{\text{OH}}{\underset{\text{CH}_3}{\text{C}}}\text{CH}_3$ (C) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\overset{\text{O}}{\parallel}\text{CCH}_3$
 (D) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CO}_2\text{H}$ (E) none of the above

(A) 54. Which one is the kinetic product of the following reaction?

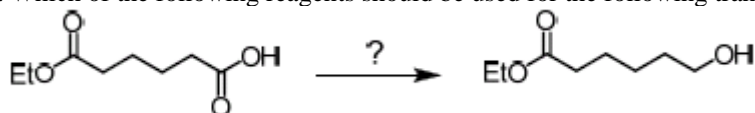


- (A)  (B)  (C)  (D)  (E) 

(C) 55. Which of the following reagents should be used to convert methyl hexanoate to hexanal?

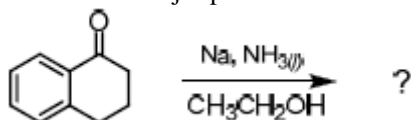
- (A) LiAlH_4 then H_3O^+ (B) NaBH_4 then H_3O^+
 (C) $[(\text{CH}_3)_2\text{CHCH}_2]_2\text{AlH}$, -78°C then H_2O (D) $\text{LiAlH}[\text{OC}(\text{CH}_3)_3]_3$, -78°C then H_2O
 (E) H_2 , Pd/C

(E) 56. Which of the following reagents should be used for the following transformation?



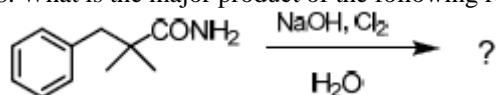
- (A) LiAlH_4 then H_3O^+ (B) NaBH_4 then H_3O^+
 (C) $[(\text{CH}_3)_2\text{CHCH}_2]_2\text{AlH}$, -78°C then H_2O (D) $\text{LiAlH}[\text{OC}(\text{CH}_3)_3]_3$, -78°C then H_2O
 (E) $\text{BH}_3 \cdot \text{THF}$ then H_2O

(D) 57. What is the major product of the following reaction?



- (A) (B) (C) (D) (E)

(D) 58. What is the major product of the following reaction?



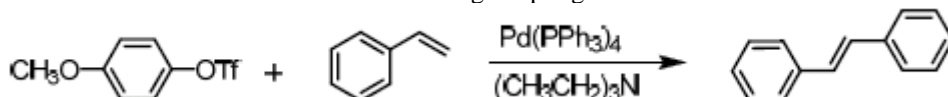
- (A) 2,2-dimethyl-3-phenylpropanoic acid (B) 2,2-dimethyl-3-chloro-3-phenylpropanoic acid
 (C) 2,2-dimethyl-3-chloro-3-(2-chlorophenyl)propanoic acid
 (D) phetamine (E) none of the above

(E) 59. What reagents are used to dehydrate amides to nitriles?

- I. P_2O_5 II. POCl_3 III. SOCl_2

- (A) I (B) II (C) III (D) I and II (E) all of the above

(D) 60. What is the named reaction of the following coupling reaction?



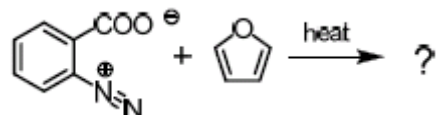
- (A) Grignard reaction (B) Gilman reaction (C) Stille reaction
 (D) Heck reaction (E) Suzuki reaction

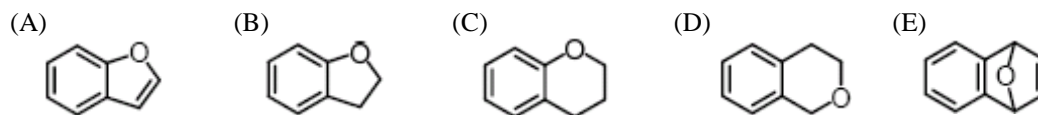
【單選題】 每題 2 分，共計 40 分，答錯 1 題倒扣 0.5 分，倒扣至本大題零分為止，未作答，不給分亦不扣分。

(D) 61. Predict the number of carbon resonance lines you would expect in the ^{13}C -NMR spectra of ethyl acrylate.

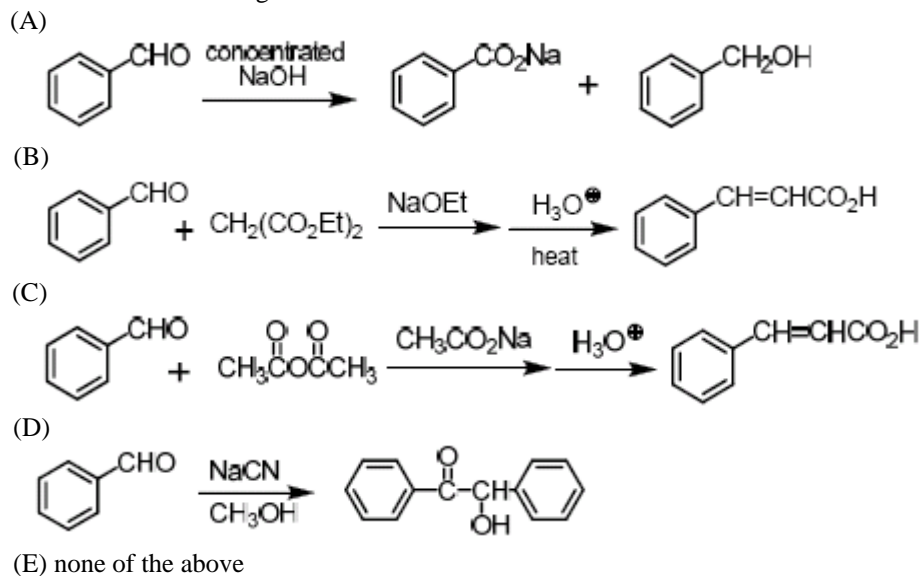
- (A) 2 (B) 3 (C) 4 (D) 5 (E) 6

(E) 62. What organic product would you expect from the following reaction?

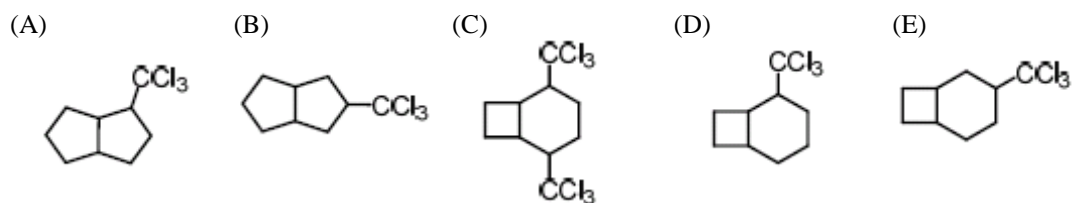
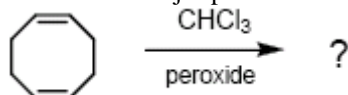




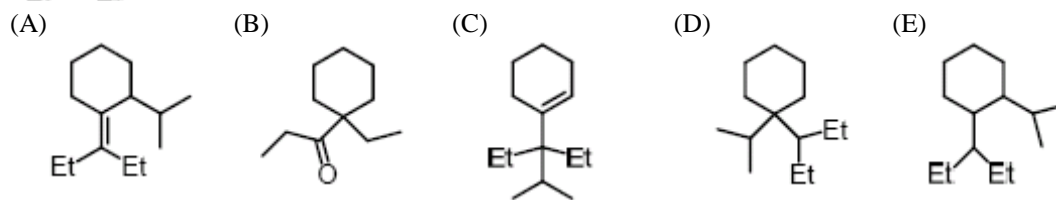
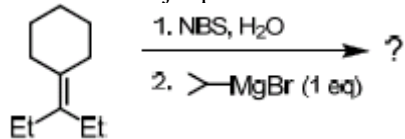
(C) 63. Which of the following reactions is called Perkin condensation?



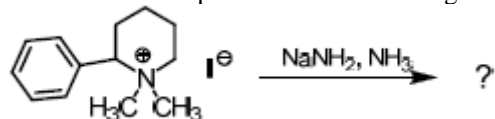
(A) 64. What is the major product for the following reaction?

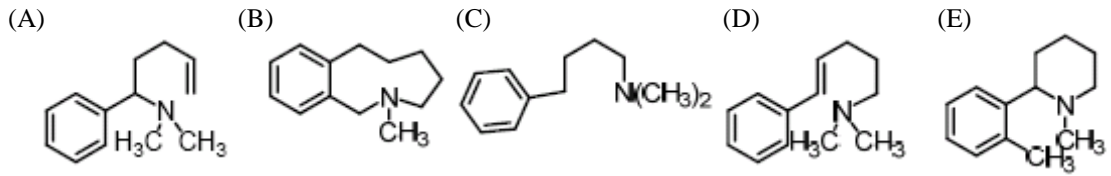


(B) 65. What is the major product of the following reaction?

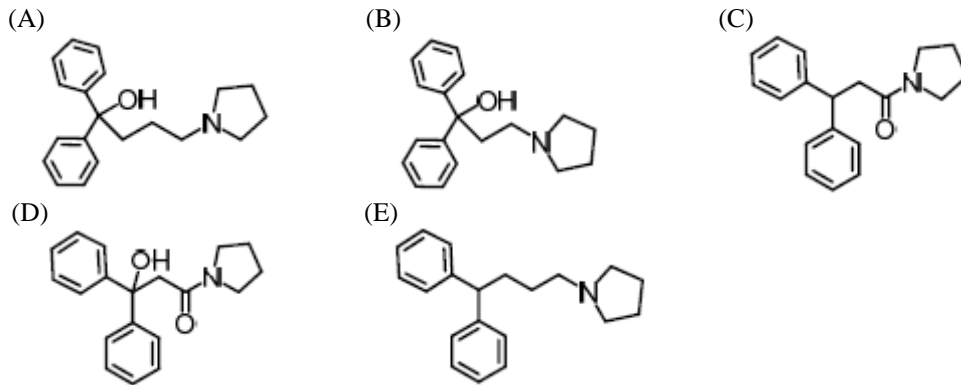
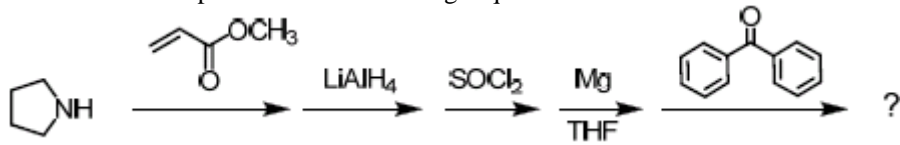


(B) 66. Provide the final product of the following reaction.

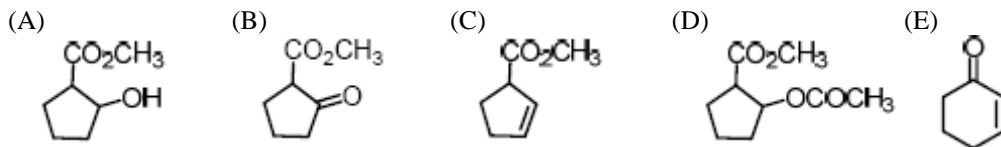
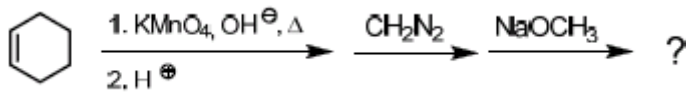




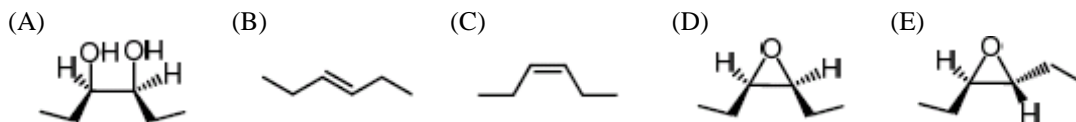
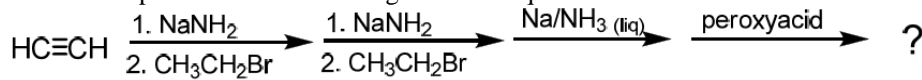
(A) 67. What is the final product of the following sequential reactions?



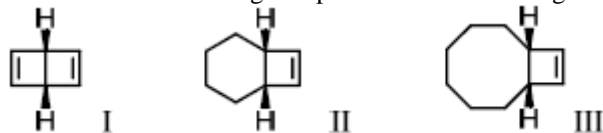
(B) 68. What is the major product of the following reaction sequence?



(E) 69. What is the product of the following reaction sequence?

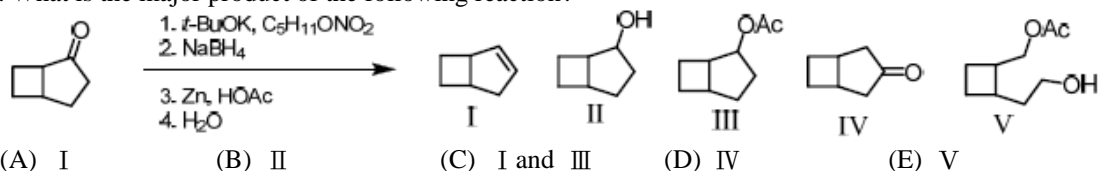


(D) 70. Which of the following compounds will **not** undergo a ring-opening reaction under thermal conditions?

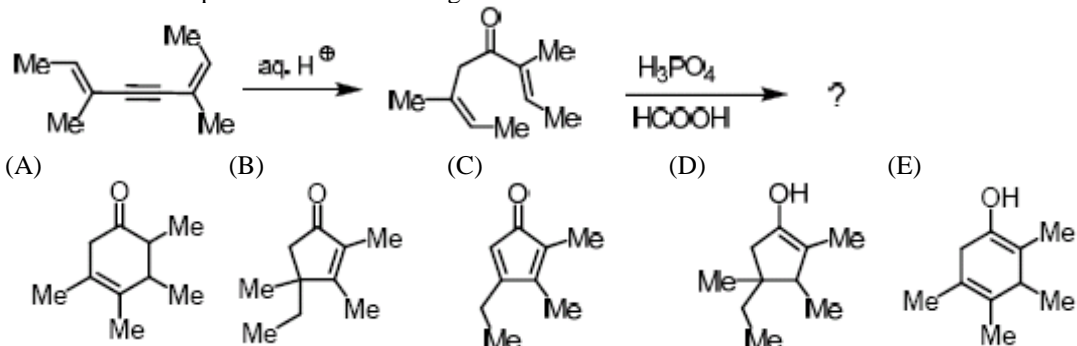


(A) I only (B) II only (C) III only (D) I and II (E) I and III

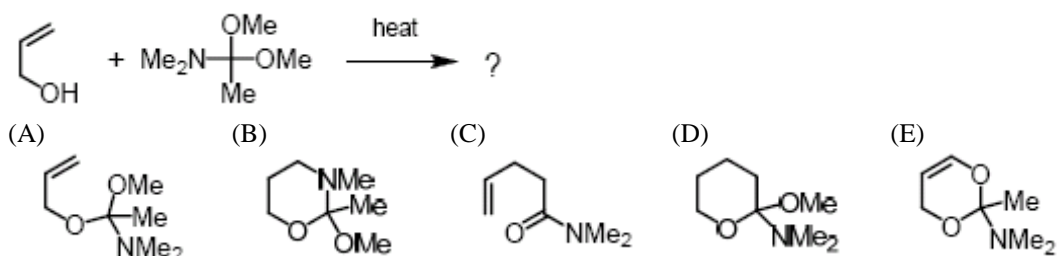
(D) 71. What is the major product of the following reaction?



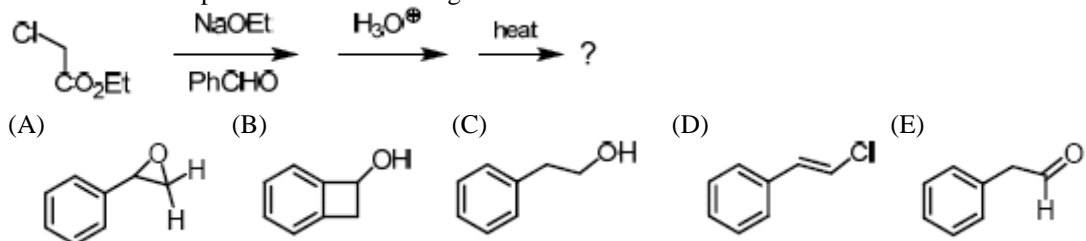
(A) 72. Provide the final product of the following reaction.



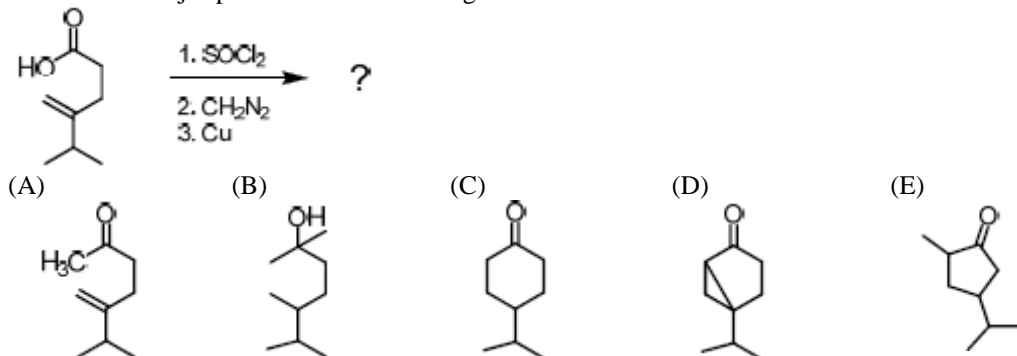
(C) 73. Provide the final product of the following reaction.



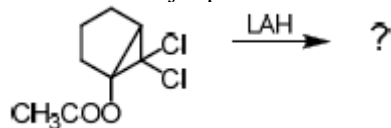
(E) 74. Provide the final product of the following reaction.



(D) 75. What is the major product of the following reaction?

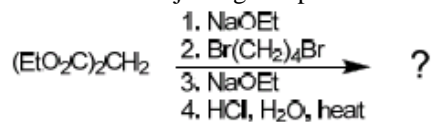


(C) 76. What is the major product of the following reaction?



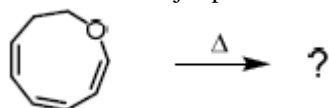
- (A) (B) (C) (D) (E)

(E) 77. Provide the major organic product of the reaction shown below.



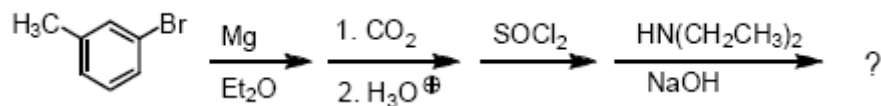
- (A) (B) (C) (D) (E)

(B) 78. What is the major product of the following reaction under thermal conditions?



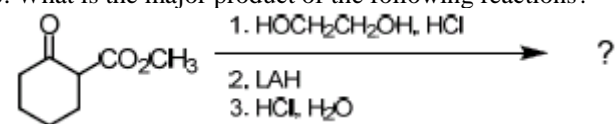
- (A) (B) (C) (D) (E)

(C) 79. Provide the final product of the following reactions.

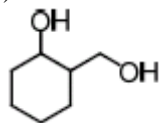


- (A) (B) (C) (D) (E)

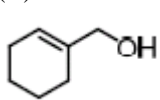
(C) 80. What is the major product of the following reactions?



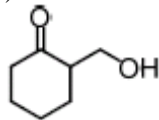
(A)



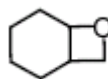
(B)



(C)



(D)



(E)

