

國立清華大學 103 學年度碩士班考試入學試題

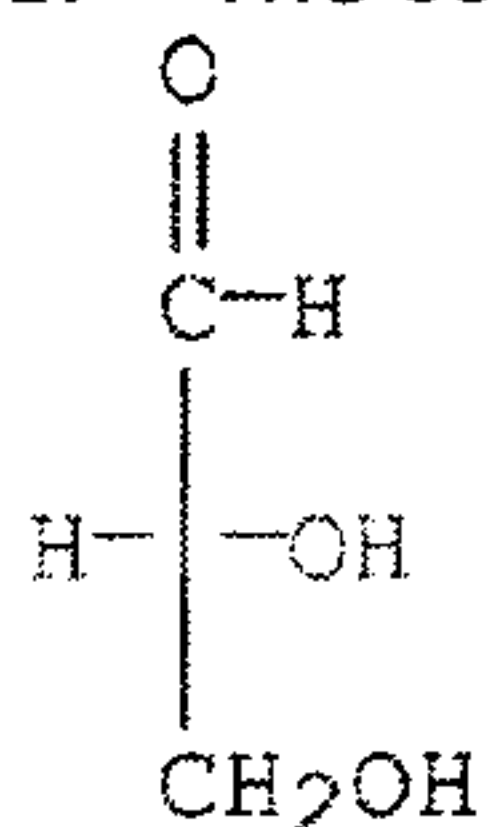
系所班組別：生醫工程與環境科學系甲組（分子生醫工程組）

考試科目（代碼）：有機化學 2304

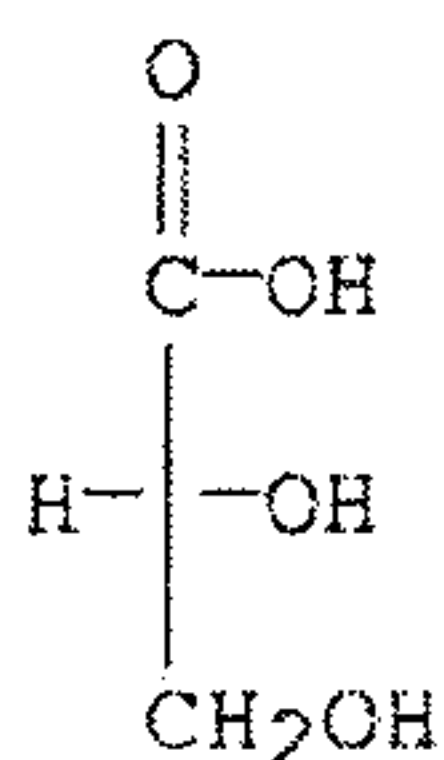
共 10 頁，第 1 頁 *請在【答案卷】作答

一、單選題（請於試卷紙上抄題號，每題 2.5 分共 55 分）

1. The configuration of *R*-(+)-glyceraldehyde is as follows:

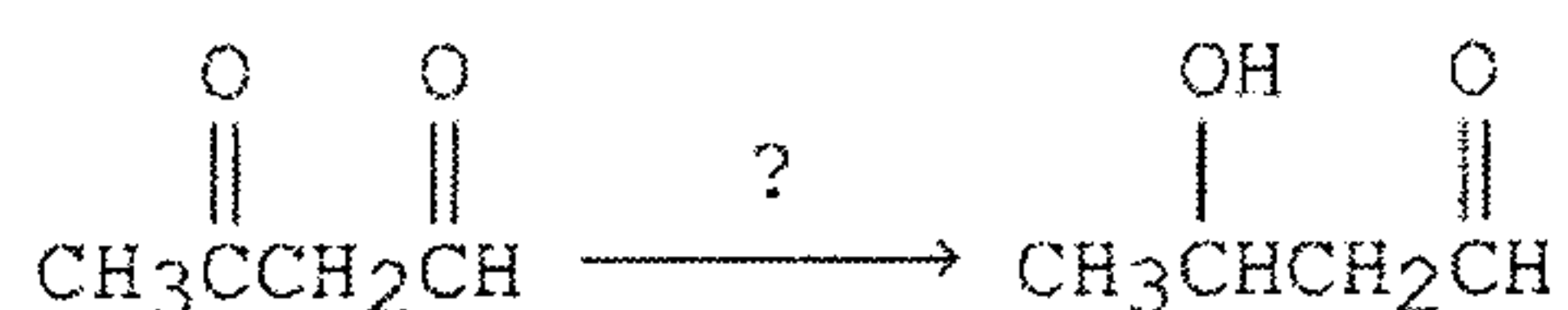


What is the absolute configuration of (-)-lactic acid?



- (A) *R* configuration
(B) *R* and *S* configuration
(C) *D* and *L* configuration
(D) *L* configuration
(E) *S* configuration
2. The specific rotation of a pure substance is -5.90° . What is the percentage of this isomer in a mixture with an observed specific rotation of -2.95° ?
- (A) 50%
(B) 80%
(C) 25%
(D) 0%
(E) 75%

3. What sequence of reactions would best accomplish the following conversion?



- (A) $\text{LiAlH}_4/\text{H}_3\text{O}^+$
(B) $\text{NaBH}_4/\text{H}_3\text{O}^+$
(C) $\text{HOCH}_2\text{CH}_2\text{OH}/\text{H}^+$; NaBH_4 ; $\text{H}^+/\text{H}_2\text{O}$
(D) H_2/Pt ; PCC
(E) $\text{KMnO}_4/\text{HO}^-$; heat

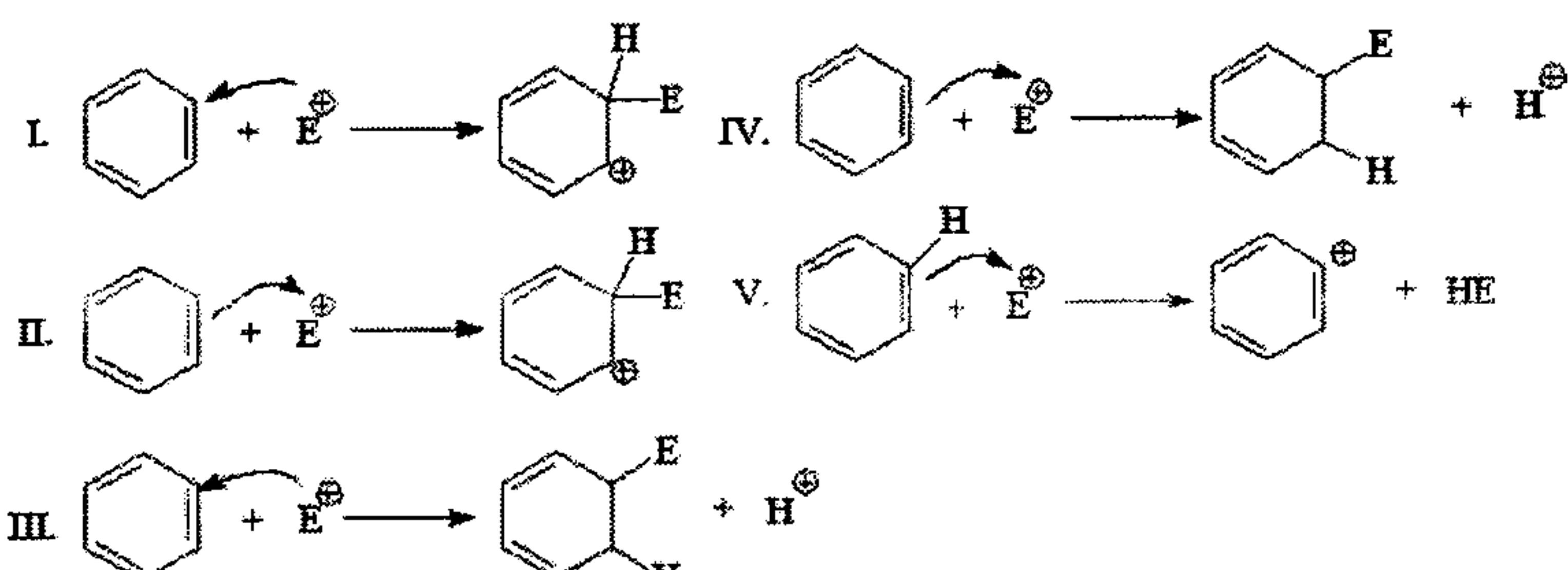
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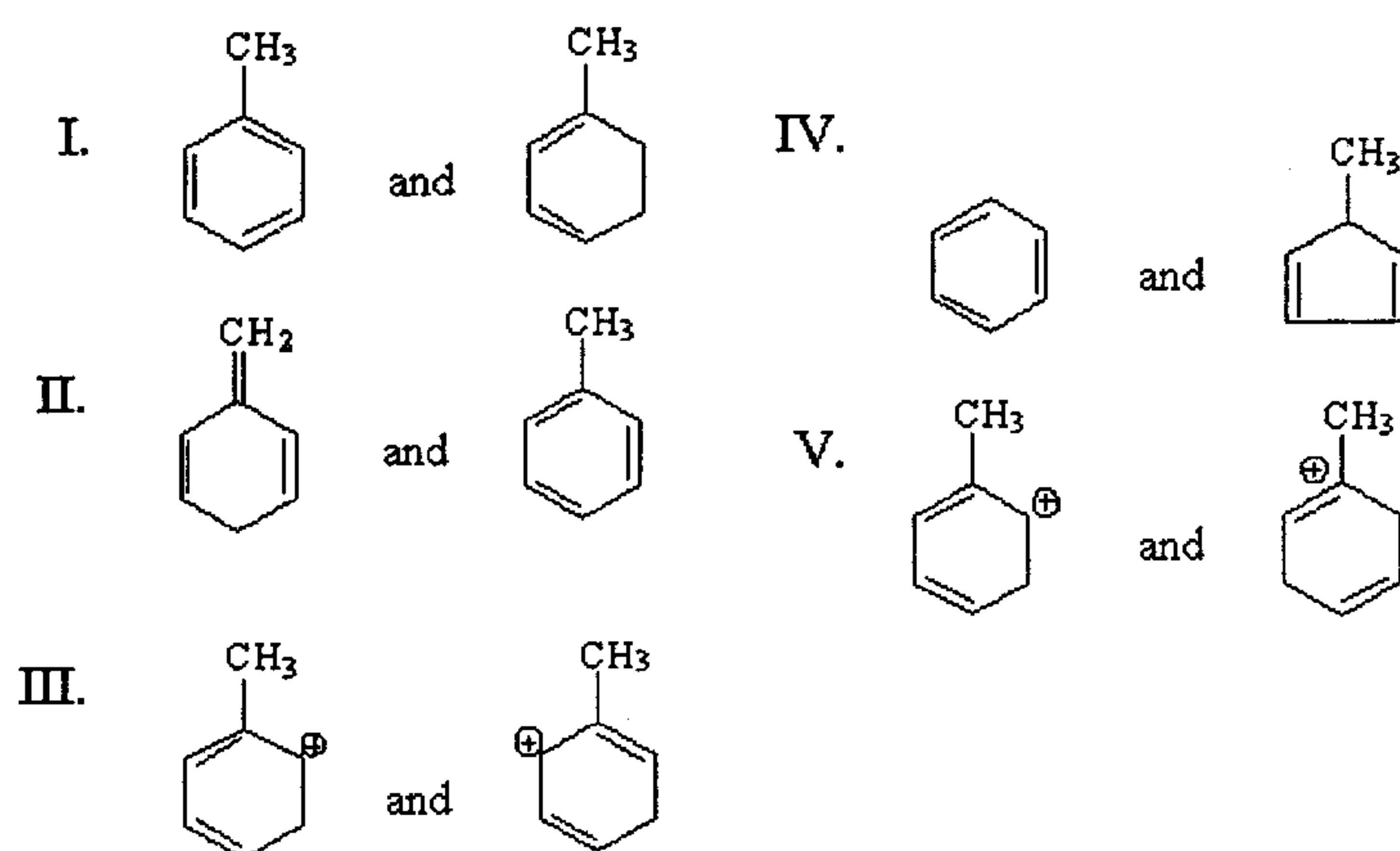
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4. Which of the following is most likely to be the first step in the general mechanism for electrophilic substitution reactions?



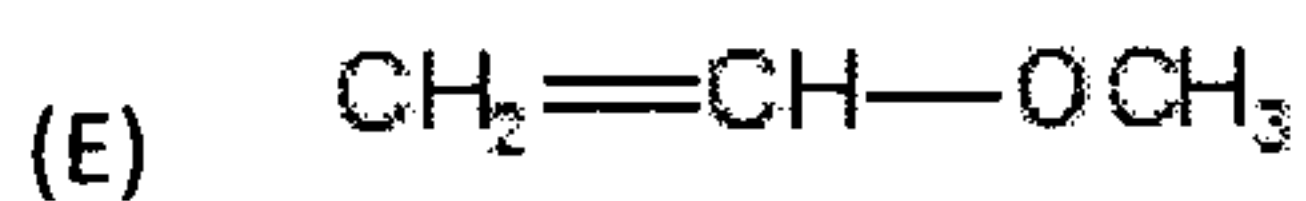
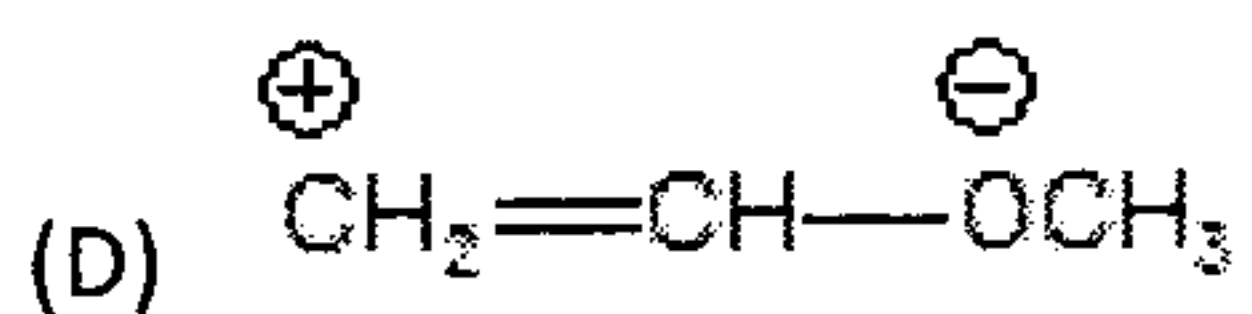
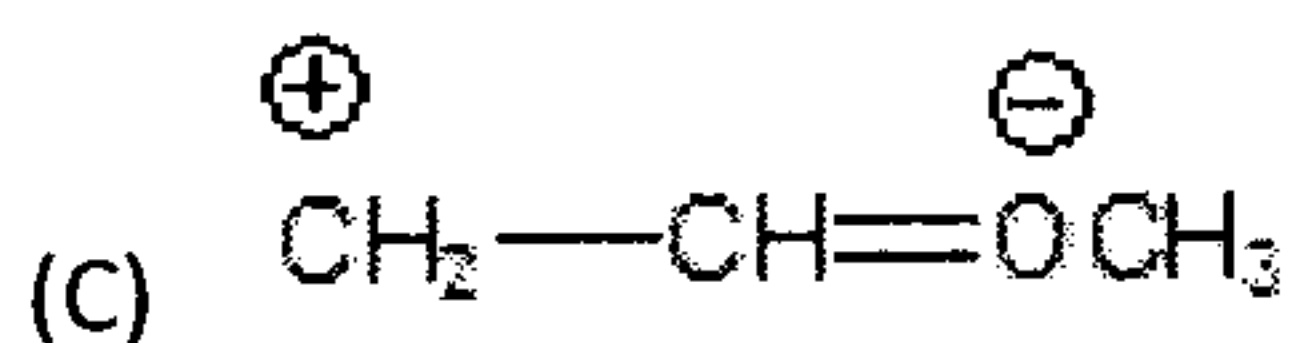
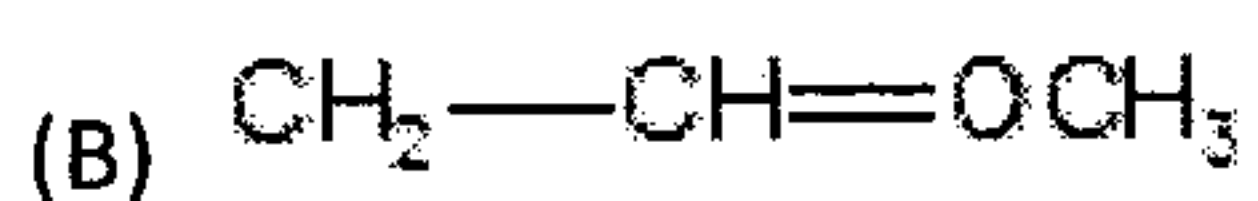
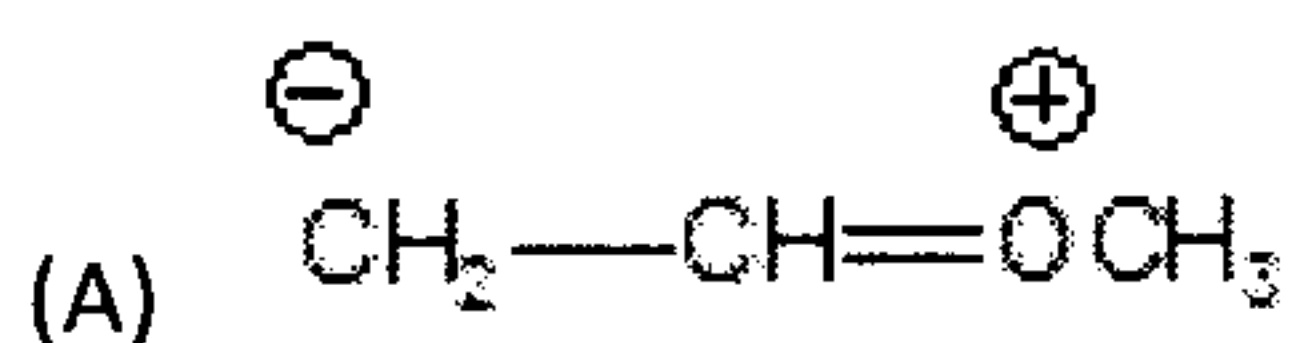
(A) I; (B) II; (C) III; (D) IV; (E) V.

5. Which of the following pairs are resonance structures?



(A) I; (B) II; (C) III; (D) IV; (E) V.

6. Identify the most stable structure(s).



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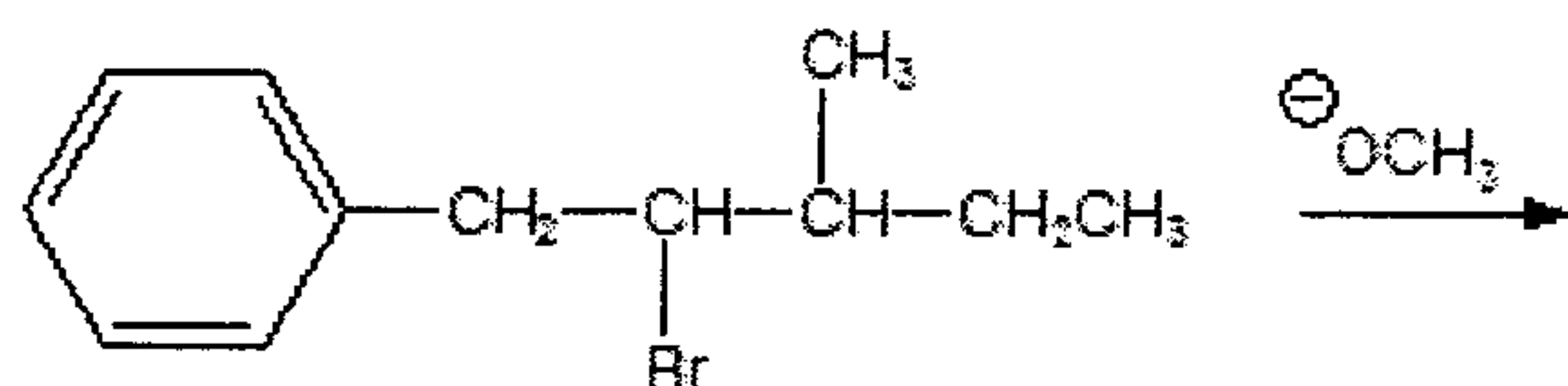
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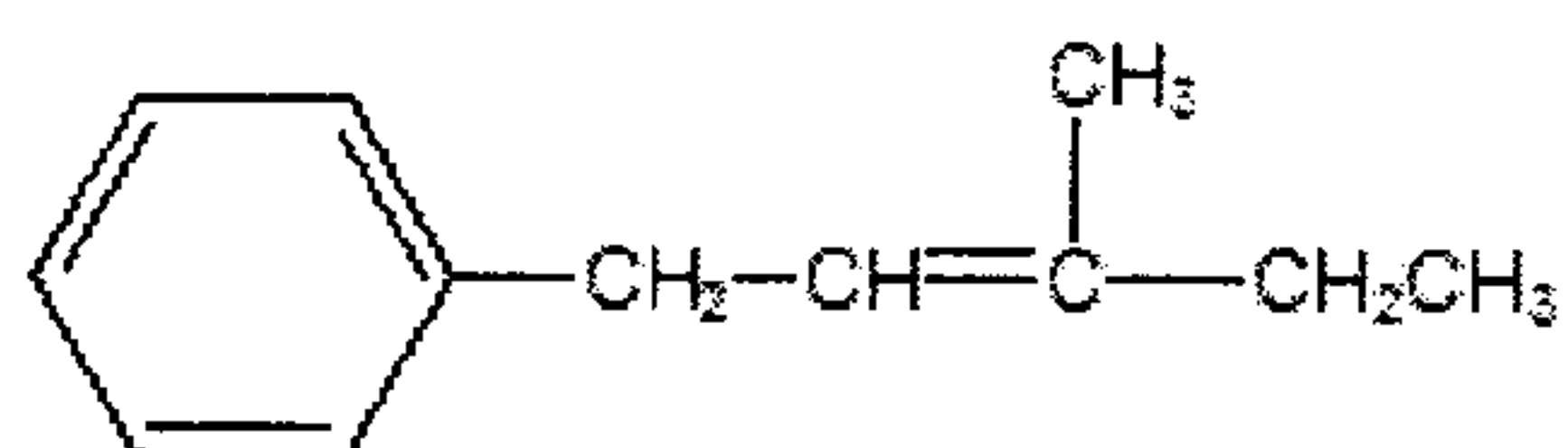
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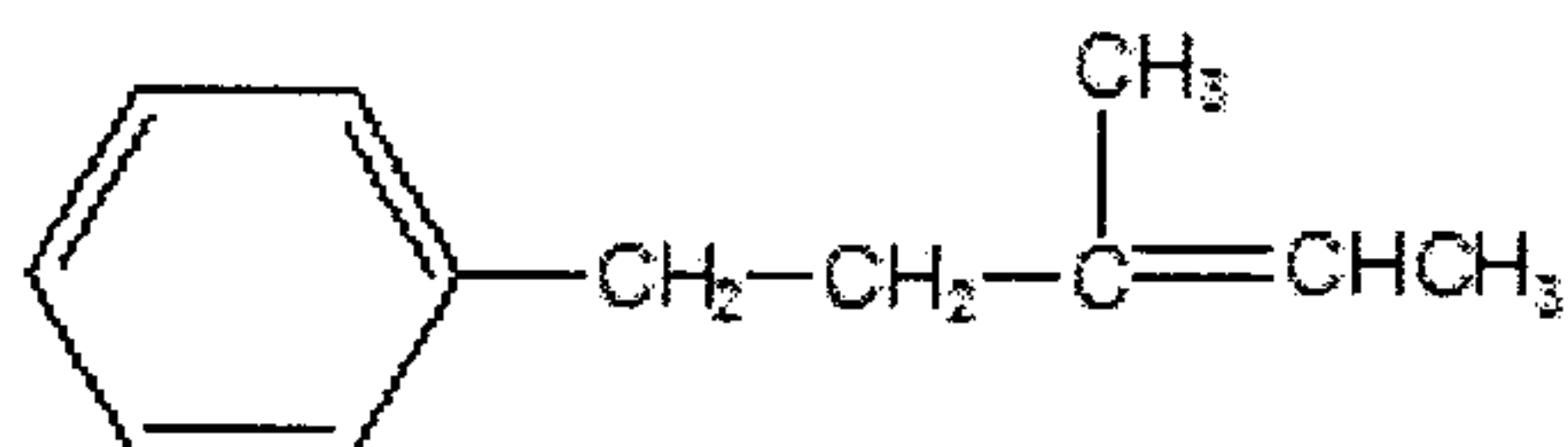
7. Give the major product for the following E2 reaction.



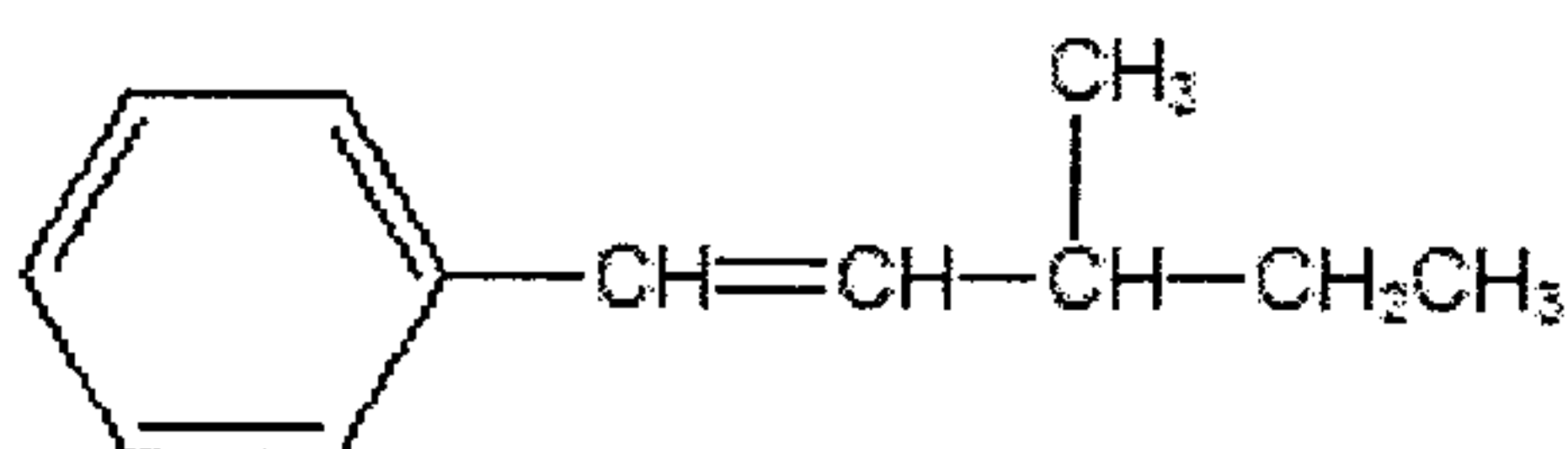
(A)



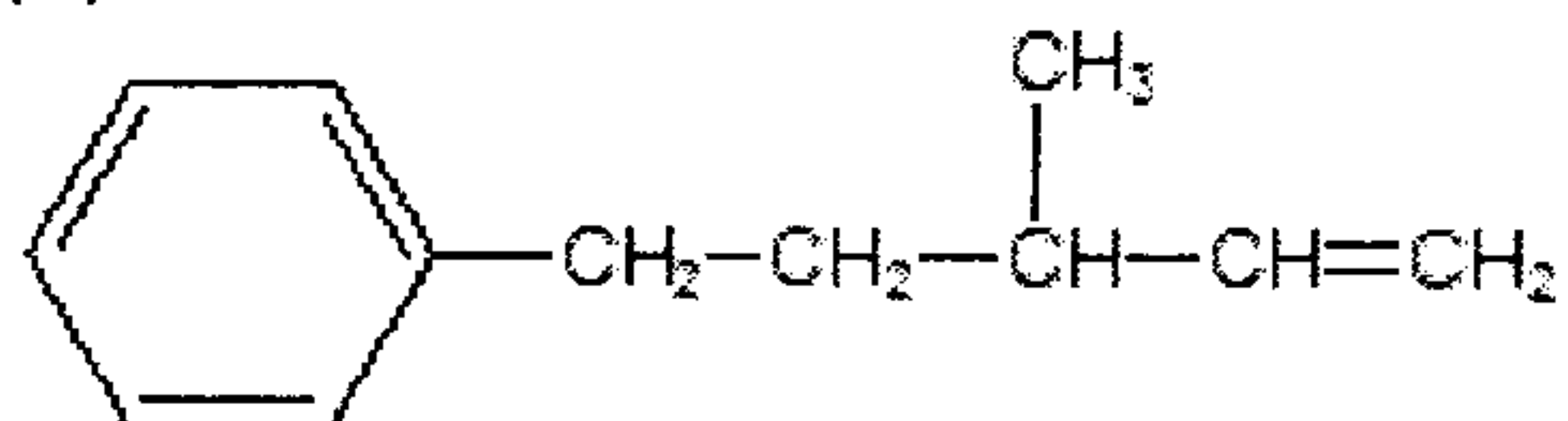
(B)



(C)



(D)



(E) none of the above

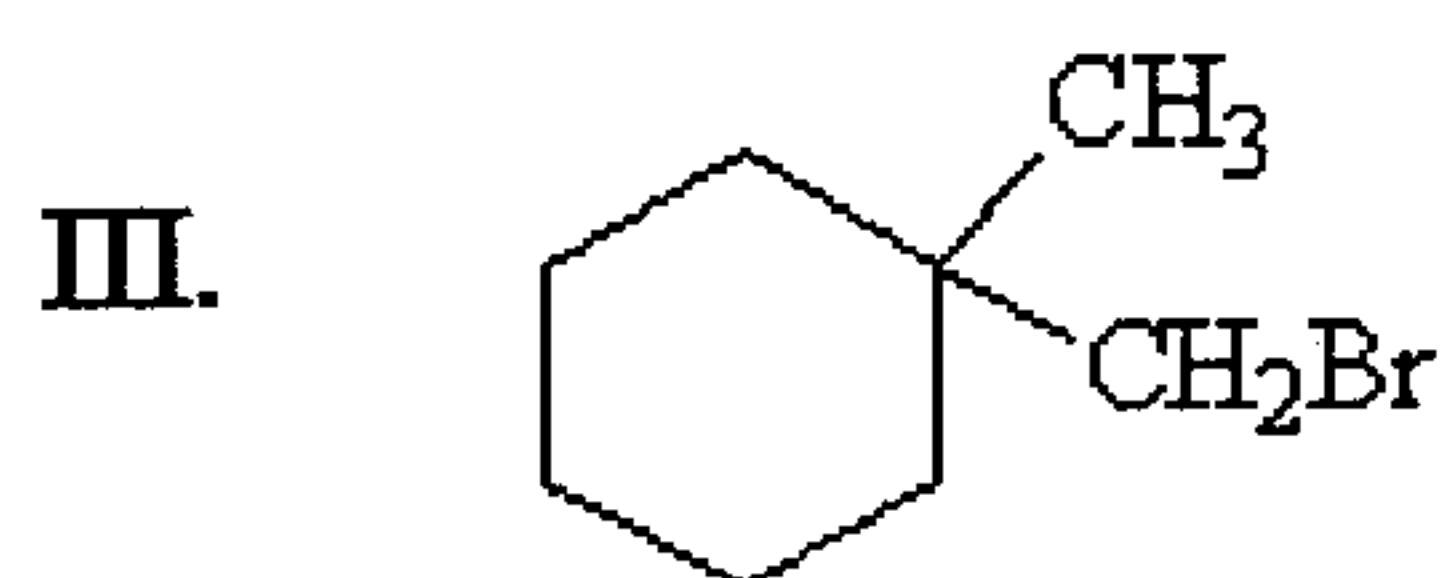
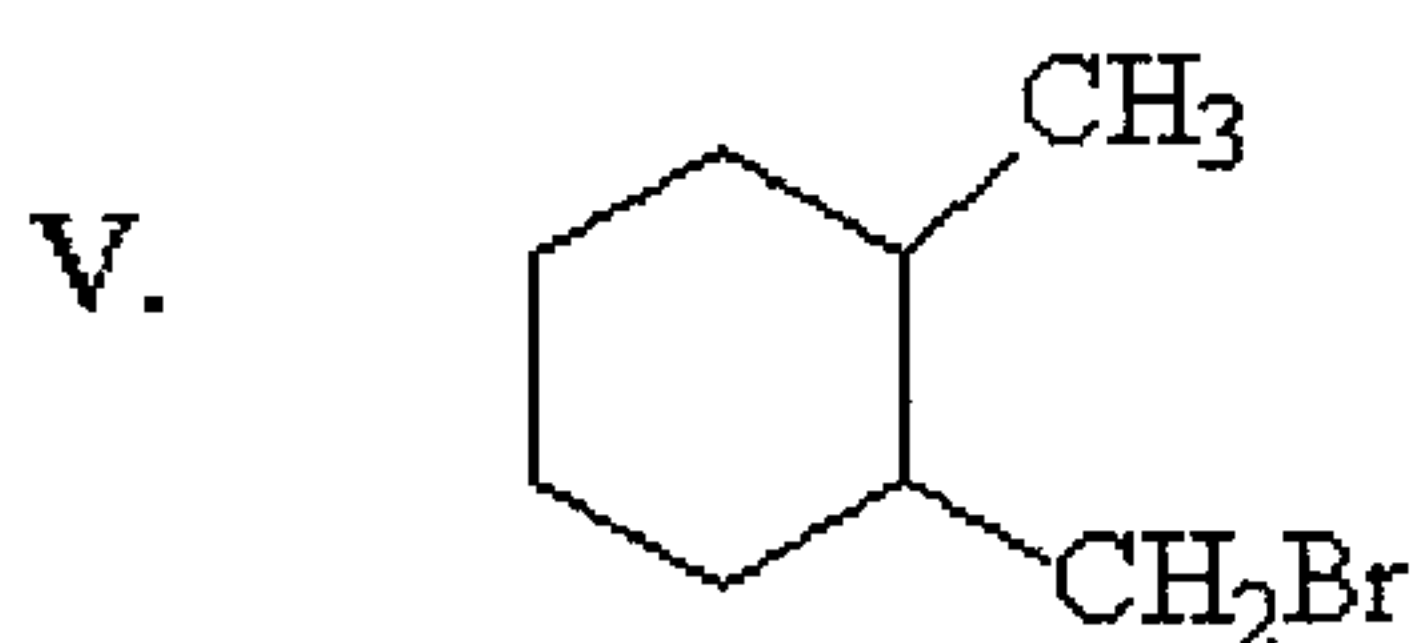
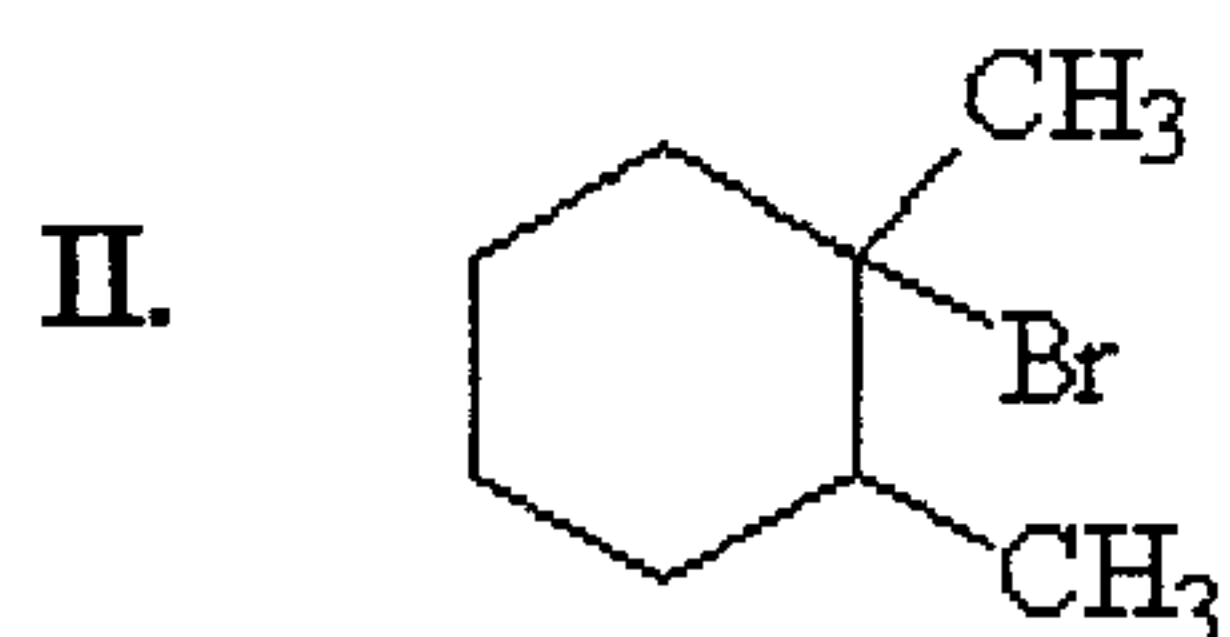
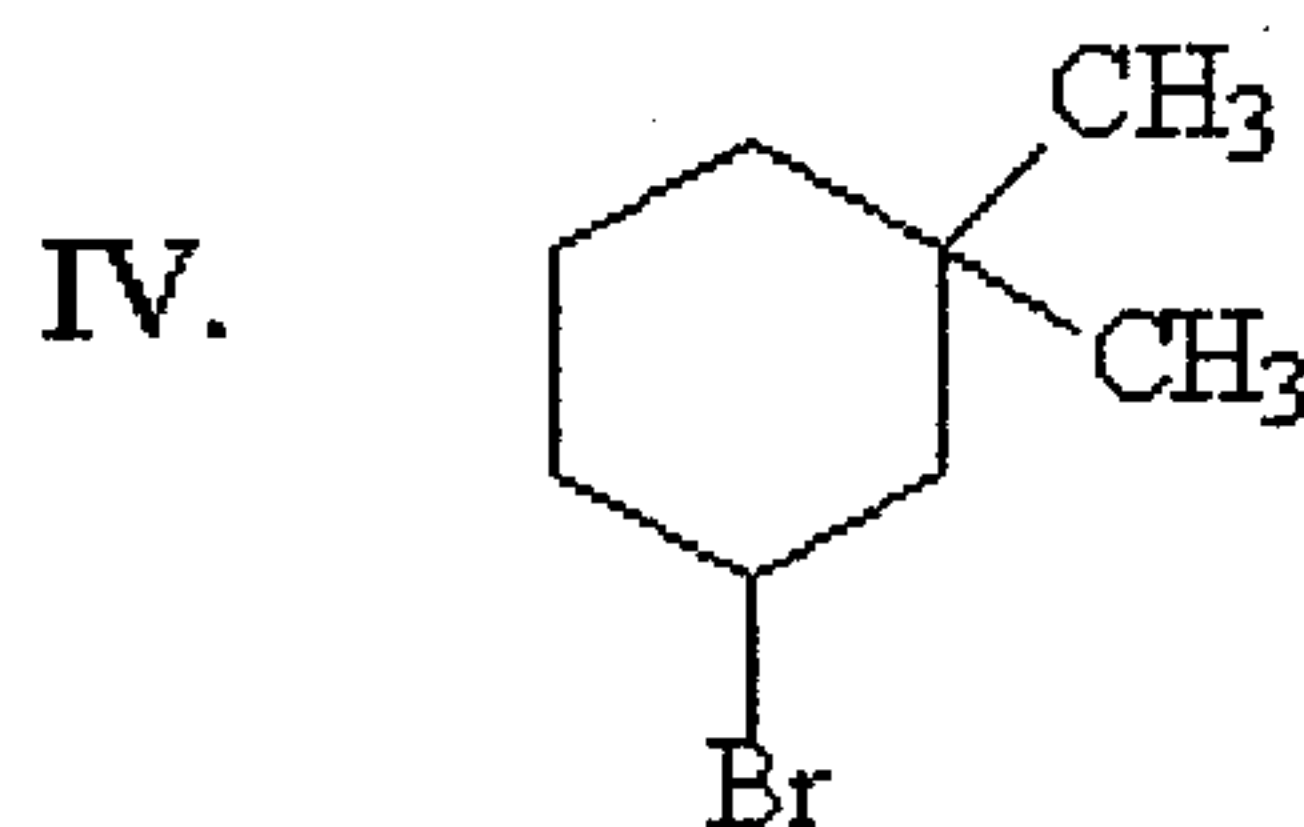
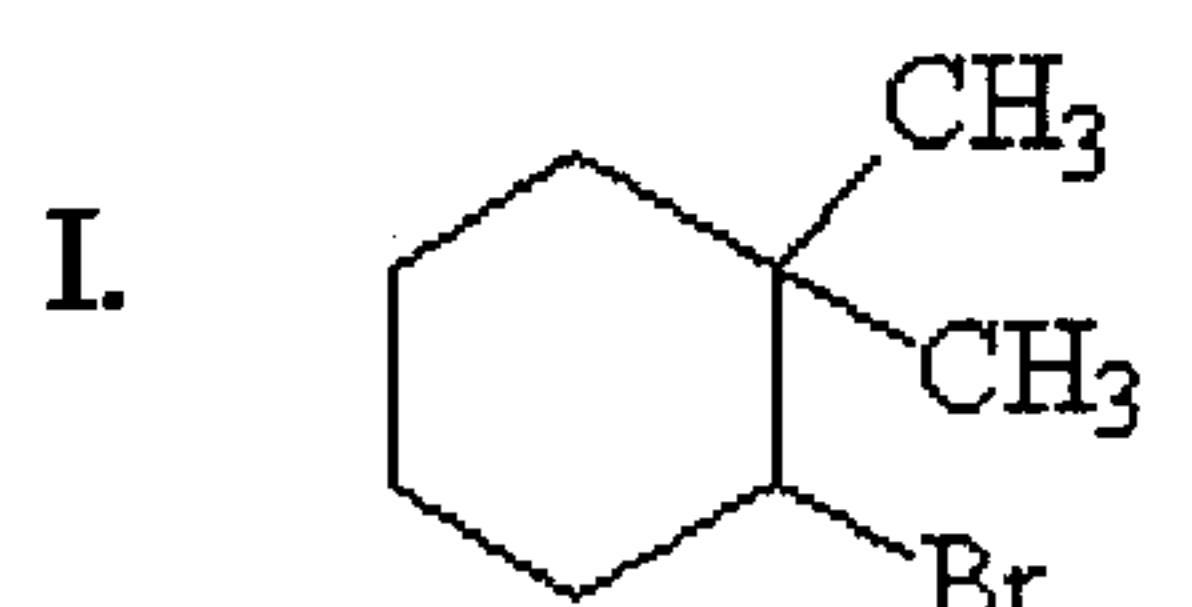
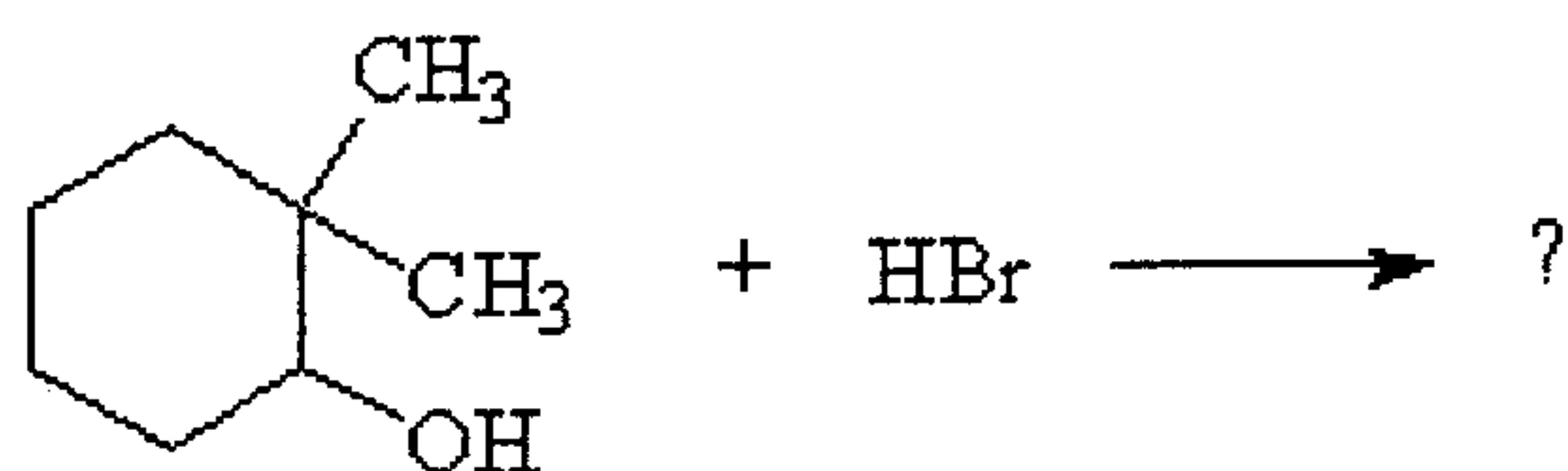
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8. What is the major product of the following reaction?



(A) I; (B) II; (C) III; (D) IV; (E) V

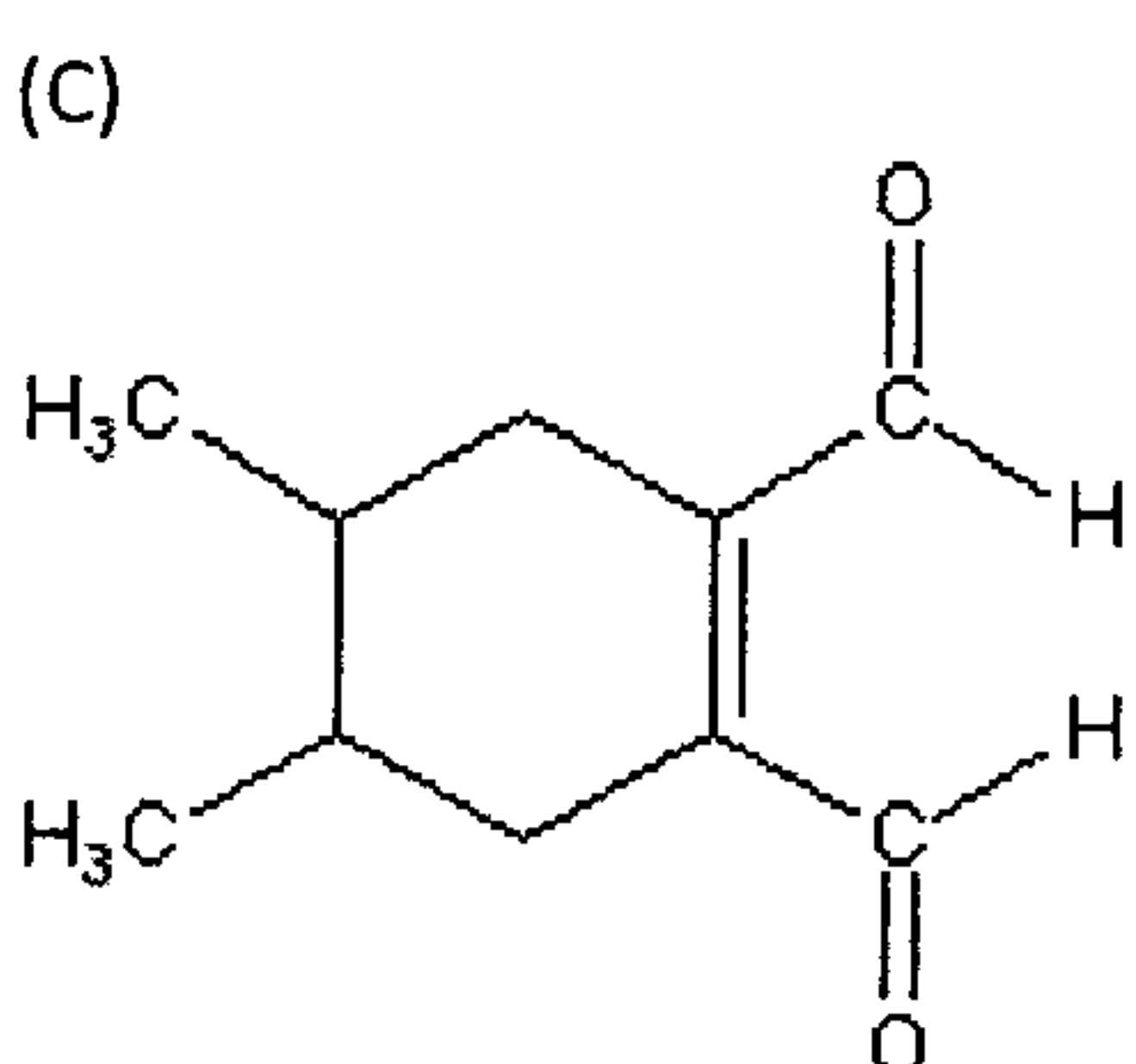
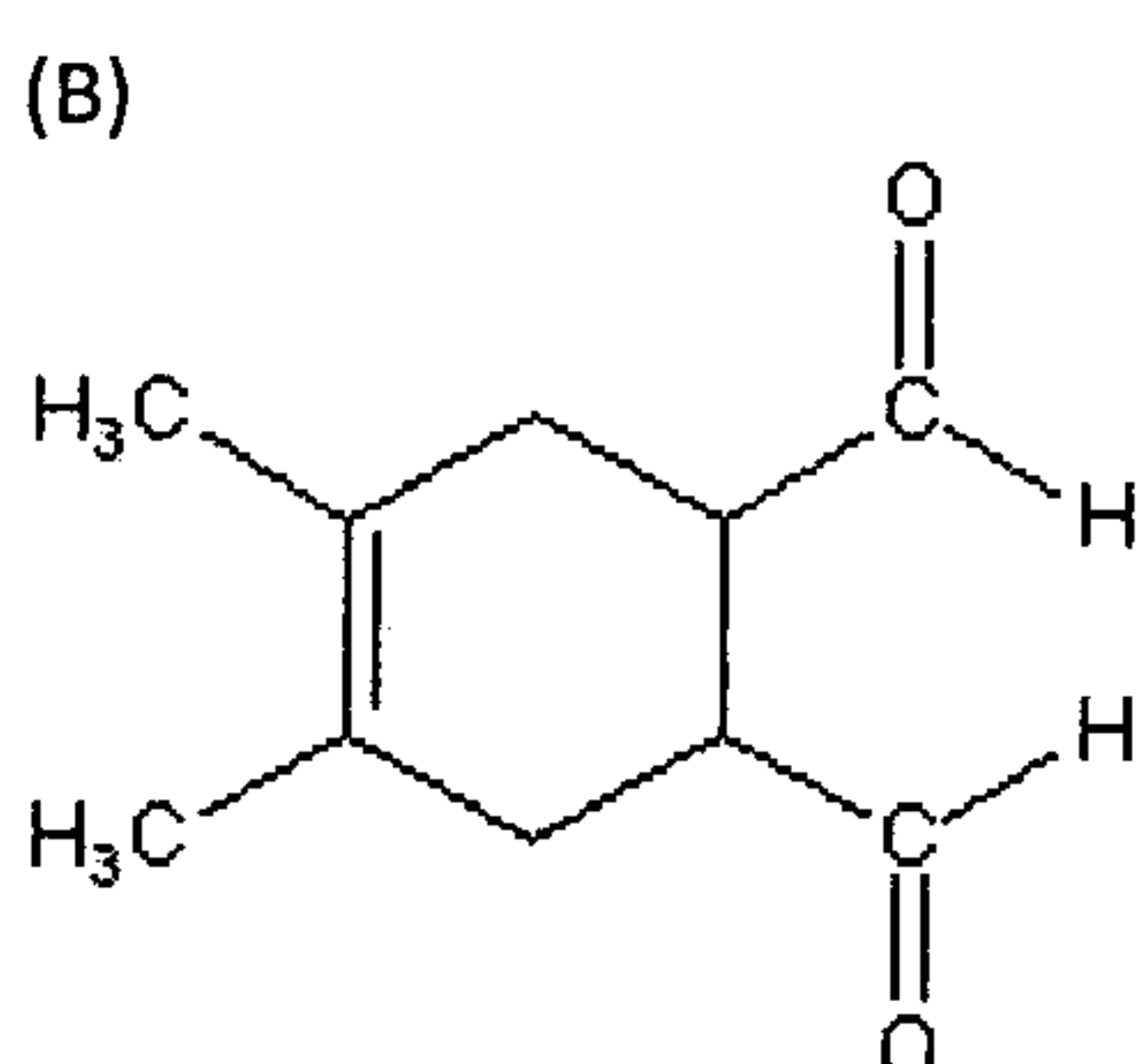
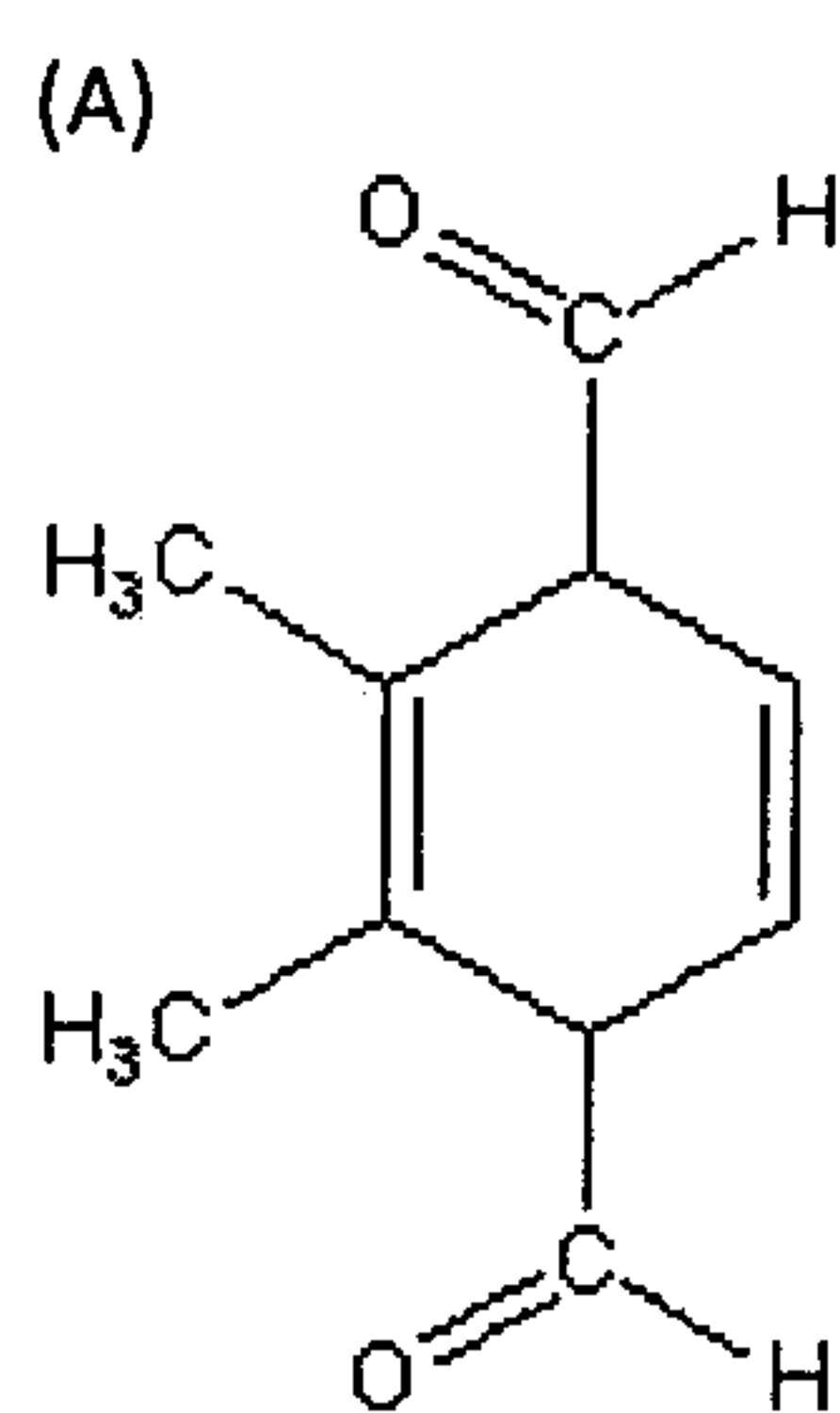
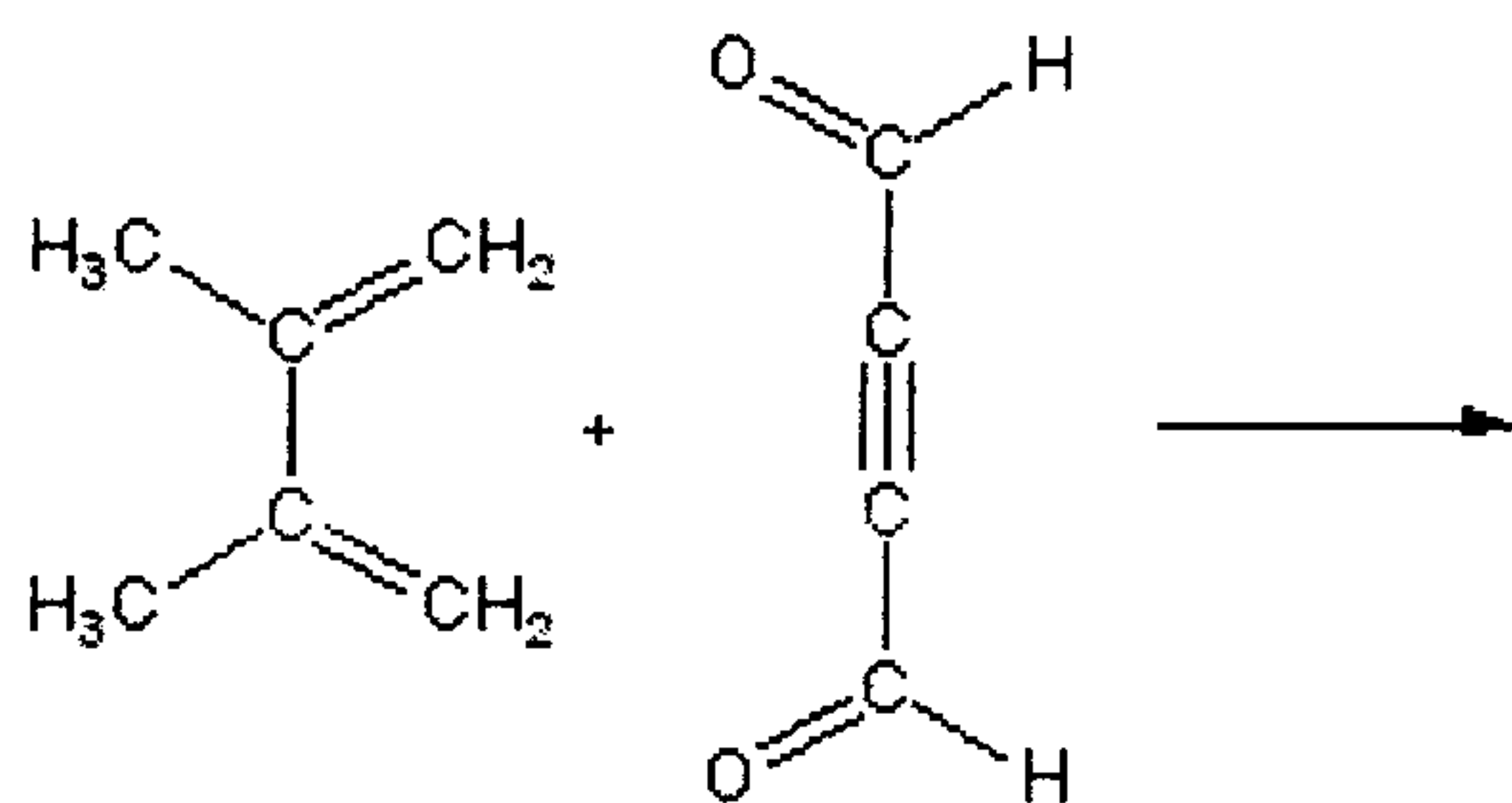
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9. Give the major organic product for the reaction.



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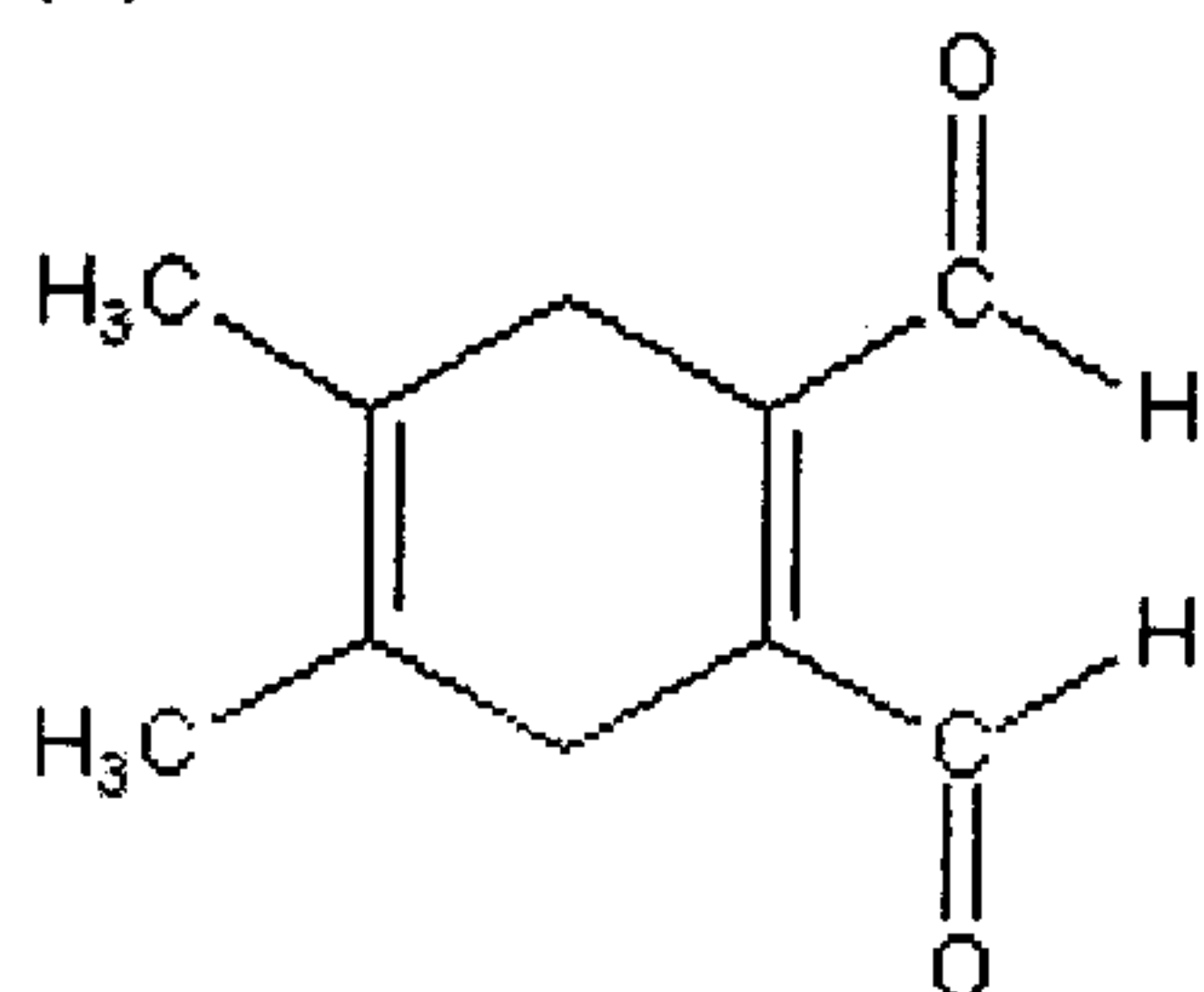
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(D)



(E)

no reaction

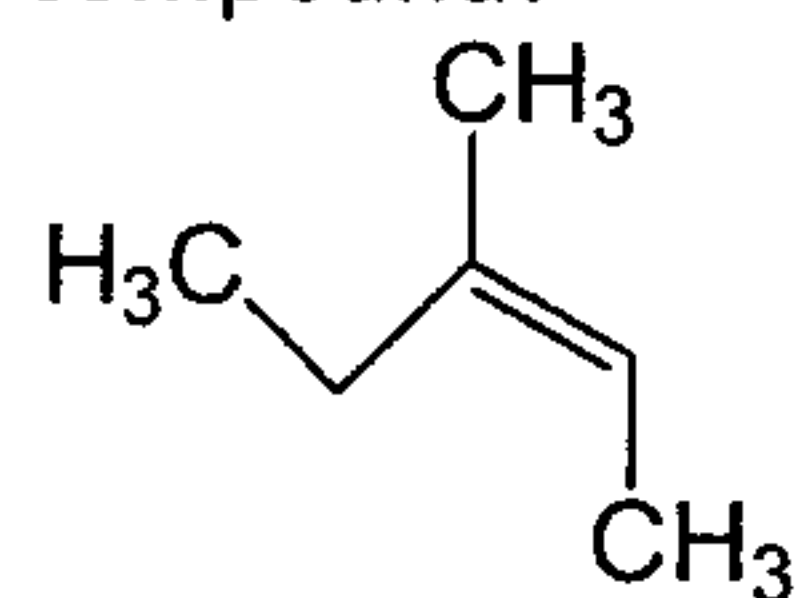
10. The reaction conditions to carry out the production of cyclopentene using bromocyclopentane as the starting material would be:

- (A) KOH, CH₃CH₃OH
- (B) H₂SO₄, THF
- (C) H₂O₂, OH⁻
- (D) Hg(OAc)₂, H₂O

11. A molecule has three degrees of unsaturation. In this molecule there would be

- (A) three rings
- (B) three double bonds
- (C) two rings and one double bond
- (D) one ring and two double bonds
- (E) any of the above

12. What is the IUPAC name of the following compound?



- (A) (E)-3-methylpent-3-ene
- (B) (Z)-3-methylpent-3-ene
- (C) (E)-3-methylpent-2-ene
- (D) (Z)-3-methylpent-2-ene

13. Which of the following amines is most basic?

- (A) aniline
- (B) N-ethylaniline
- (C) N,N-diethylaniline
- (D) piperidine
- (E) pyrrole

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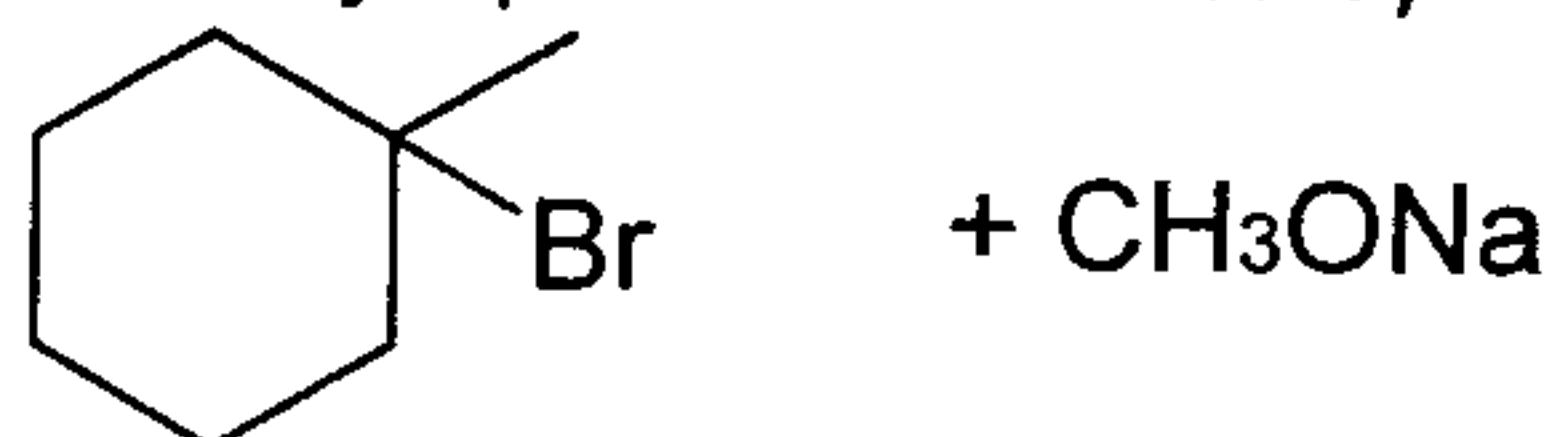
14. Which reagent would convert cyclohexene into a *cis*-glycol?

- (A) cold dilute potassium permanganate
- (B) hydrogen peroxide and aqueous acetic acid
- (C) ozone and moist zinc dust
- (D) periodic acid
- (E) sodium tert-butoxide in chloroform

15. How many different form(s) for 1,3-dichloroallene and the relationship is

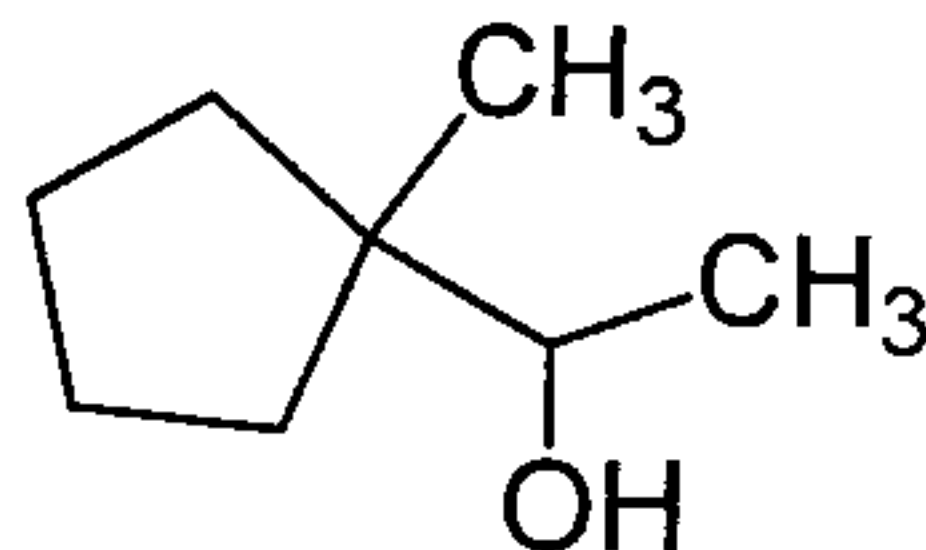
- (A) 1 form only
- (B) 2 forms and there are enantiomeric forms
- (C) 2 forms and there are diastereomeric forms
- (D) 3 forms and there are enantiomeric forms

16. For the reaction shown below, the major product is formed by



- (A) a S_N1 reaction
- (B) a S_N2 reaction
- (C) a E1 reaction
- (D) a E2 reaction

17. The reaction below yield a product (C₈H₁₄) which contain no cyclopentane ring. What is the product?

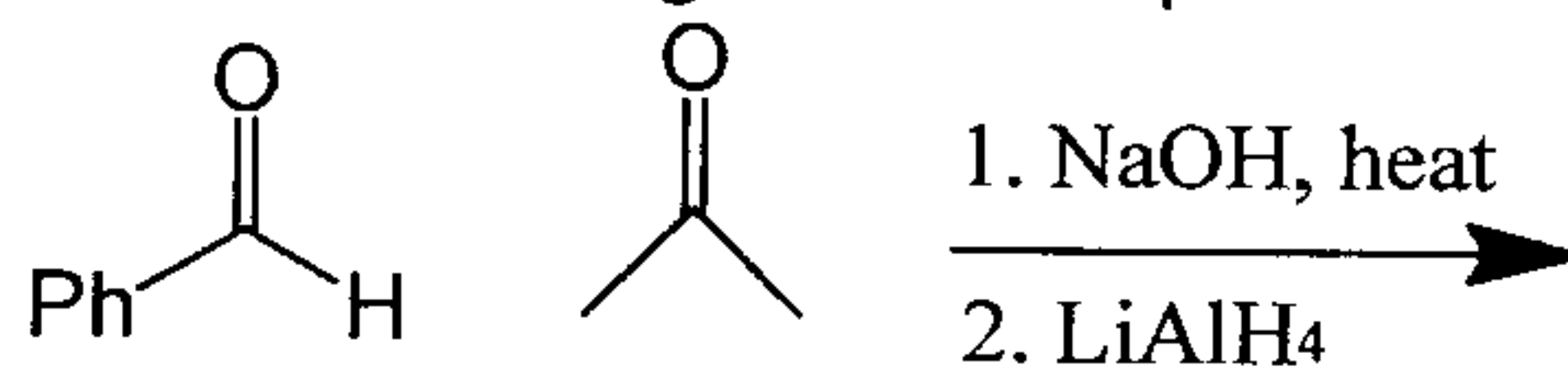


- (A) 1,2-dimethylcyclohexane
- (B) cyclooctene
- (c) 1-octyne
- (D) 3,3-dimethylcyclohexane
- (E) 1,2,3,4-tetramethylcyclobutene

18. The reaction of PhMgBr with formaldehyde HCHO, followed by treatment with H₂O gives:

- (A) benzaldehyde
- (B) benzyl alcohol
- (C) benzoic acid
- (D) benzophenone

19. What would be the final product of following reaction sequence?



- (A) PhCH₂CH₂C(OH)Me
- (B) PhCH(OH)CH₂C(OH)Me
- (C) PhCH₂CH₂CH₂Me
- (D) PhCH=CHCH(OH)Me
- (E) None of these

20. What is the major product which results when tetrahydrofuran is reacted with excess HBr?

- (A) 1,2-dibromobutane
- (B) 1,3-dibromobutane
- (C) 1,4-dibromobutane
- (D) 4-bromobutan-ol
- (E) 3-bromobutan-1-ol

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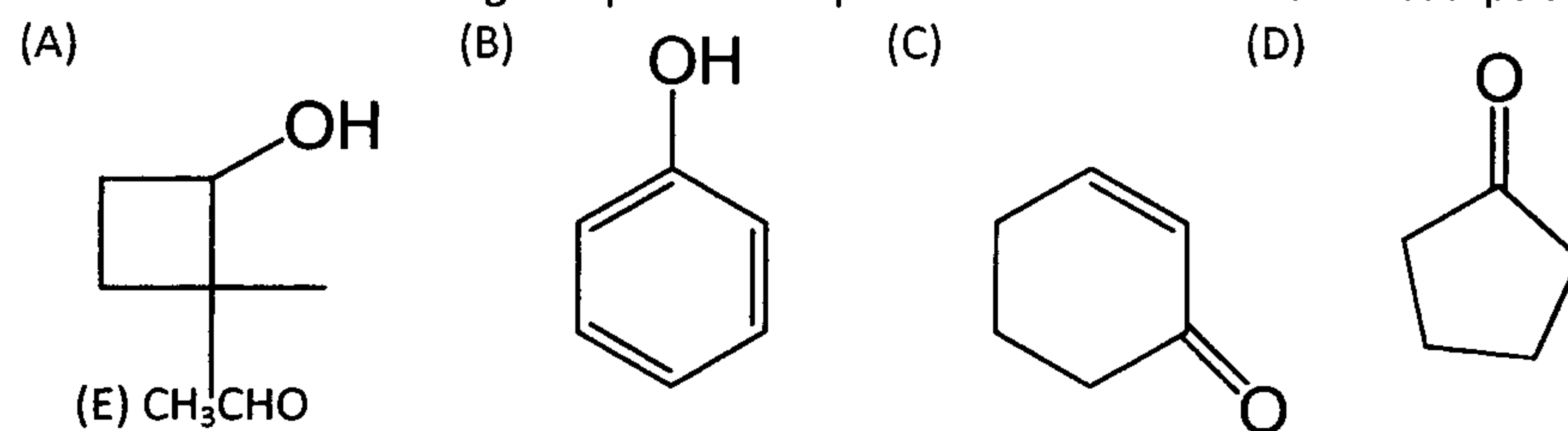
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21. Which of the following compound is the least reactive toward 1-propanol in Nucleophilic Acyl Substitution?

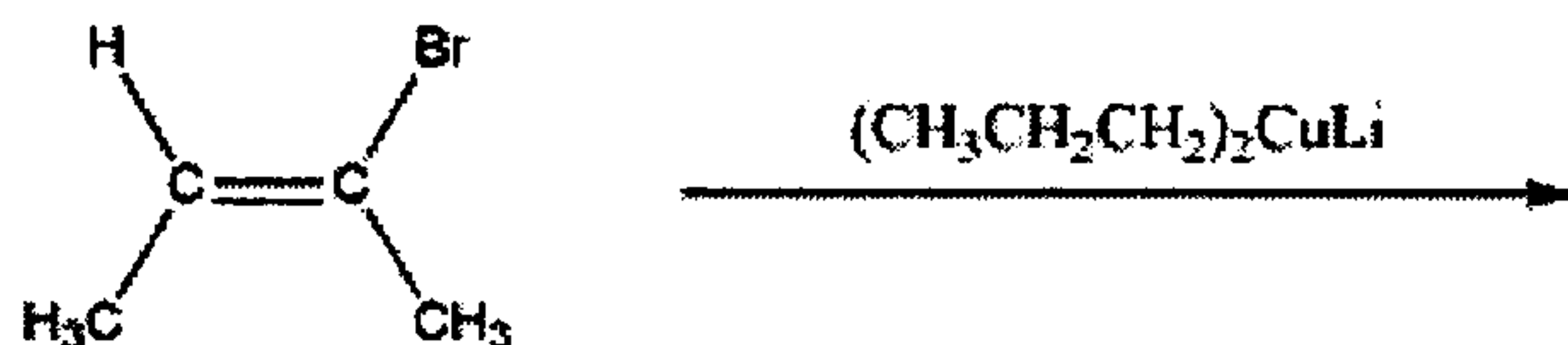
- (A) acetyl bromide (B) acetamide (C) acetic anhydride (D) ethyl acetate

22. Which of the following compound is expected to show intense IR absorption at 1689 cm^{-1} .

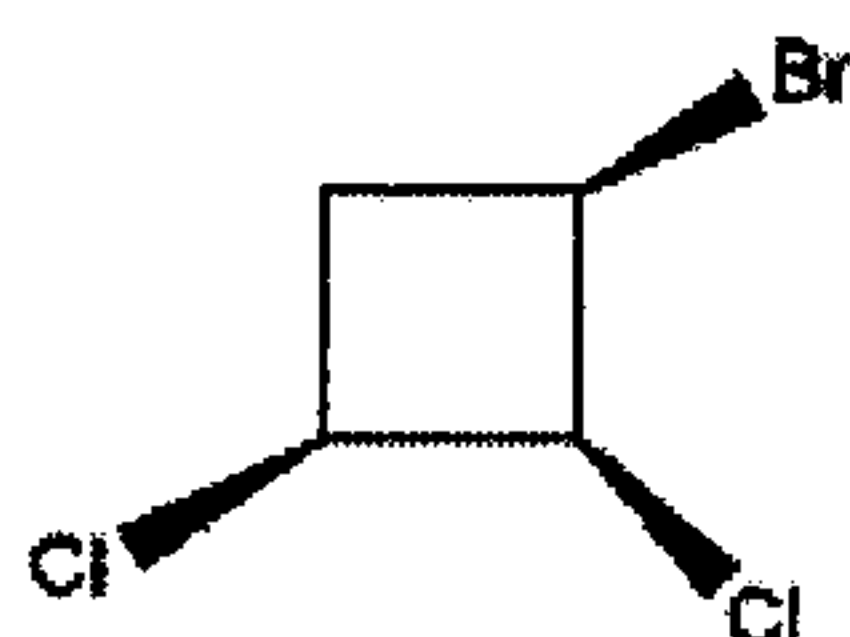


二、問答題（每題 3 分共 45 分）

1. Draw the structure of (2*S*,3*R*)-dichloropentane. Take particular care to indicate three-dimensional stereochemistry detail properly.
2. Provide the major organic product of the reaction below.



3. Label the molecule shown as chiral or achiral.



4. Draw the three major resonance structures of the carbocation intermediate in the reaction of acetophenone with $\text{HNO}_3/\text{H}_2\text{SO}_4$ to yield *o*-nitroacetophenone. Circle the resonance form which is less stable than the other two.

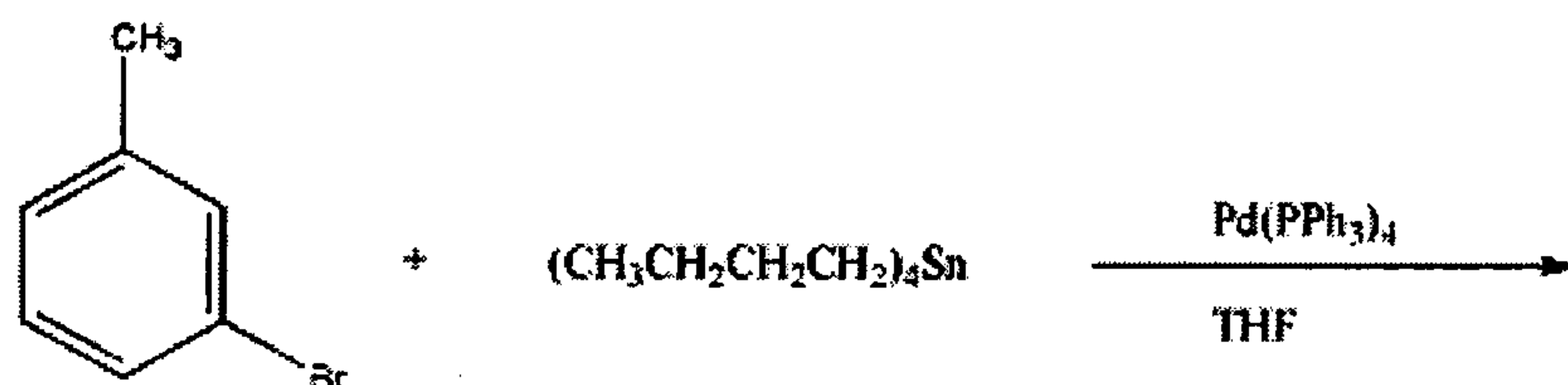
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5. Provide the major organic product of the reaction below.



6. An unknown compound, $\text{C}_3\text{H}_5\text{Cl}_3$, gave the following proton NMR data:

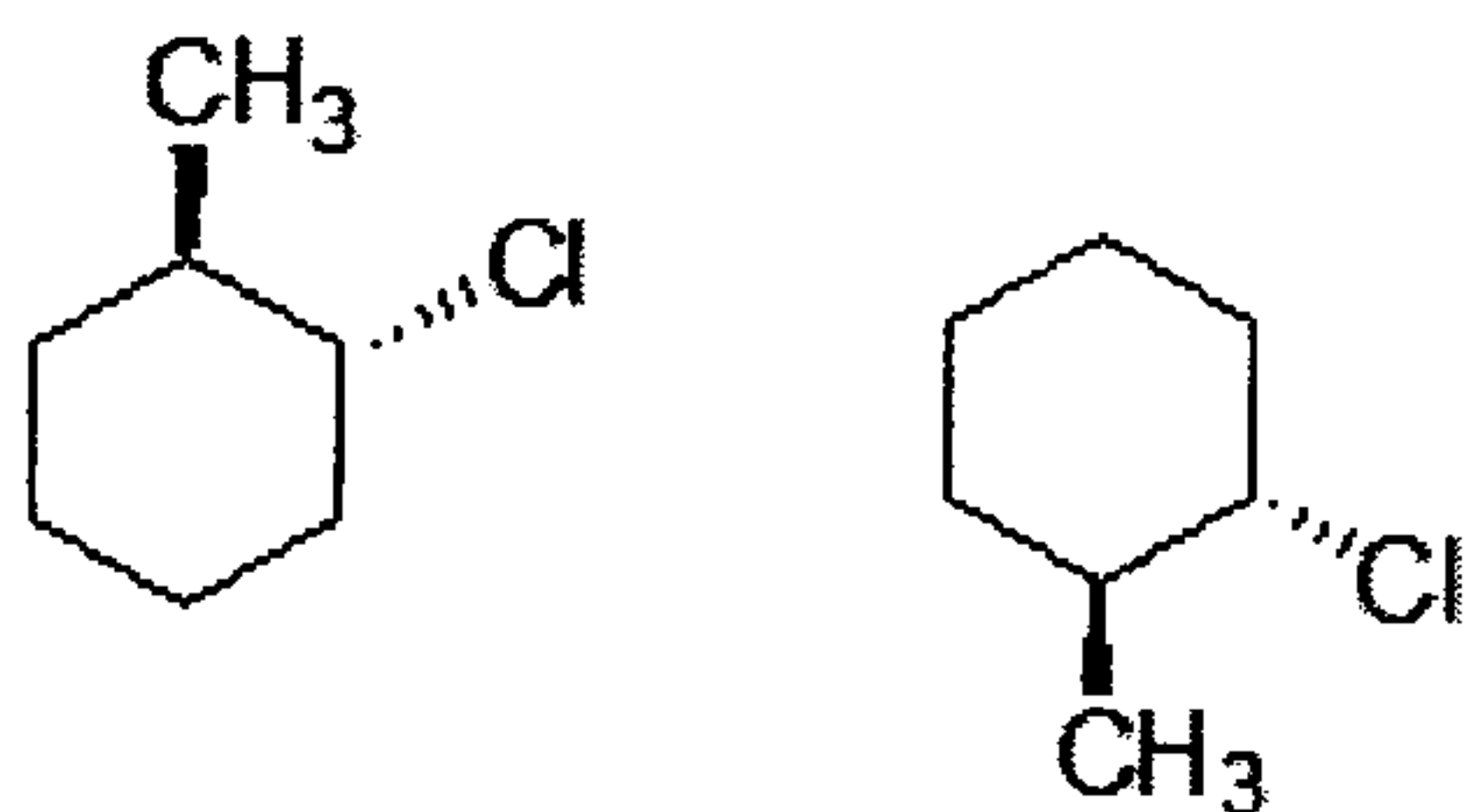
Doublet at 1.70 ppm (3H)

Multiplet at 4.32 ppm (1H)

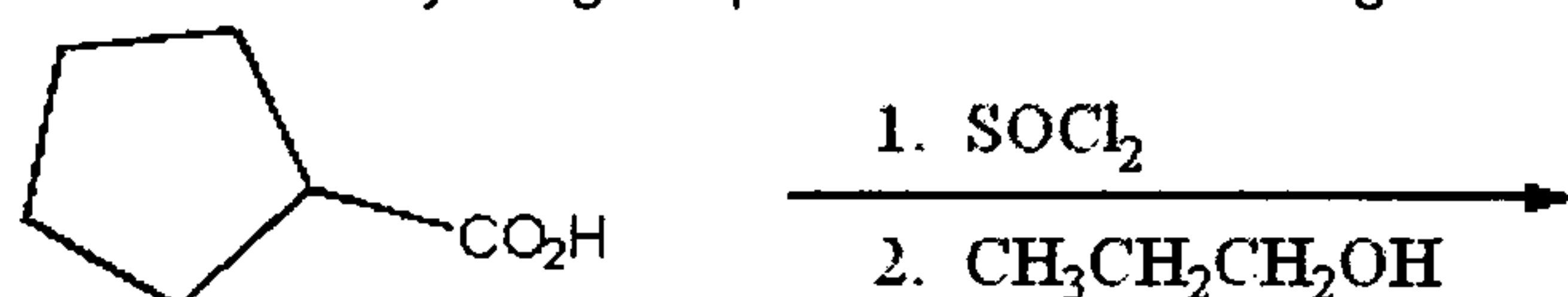
Doublet at 5.85 ppm (1H)

What is the structure of the compound?

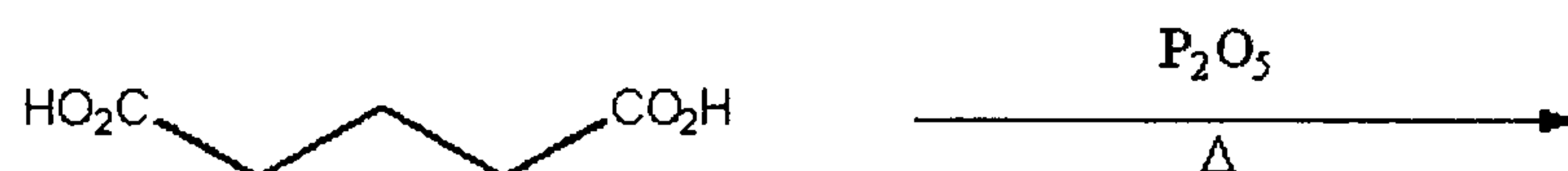
7. Which of the following terms best describes the pair of compounds shown: enantiomers, diastereomers, or the same compound?



8. Provide the major organic product of the following.



9. Provide the major organic product of the following.



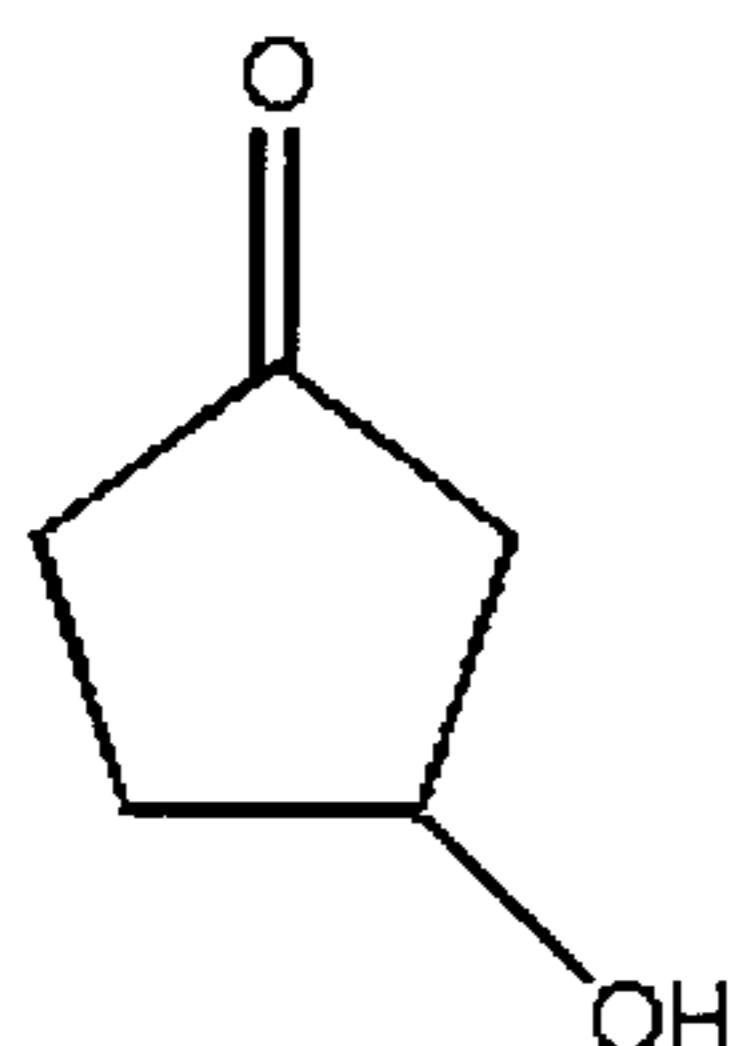
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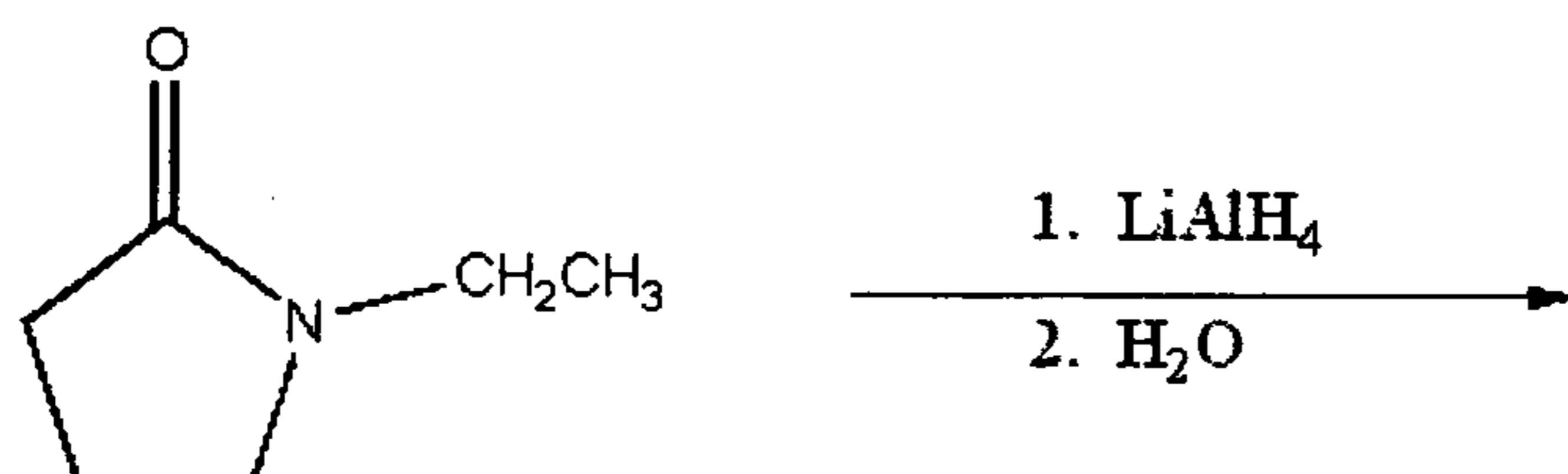
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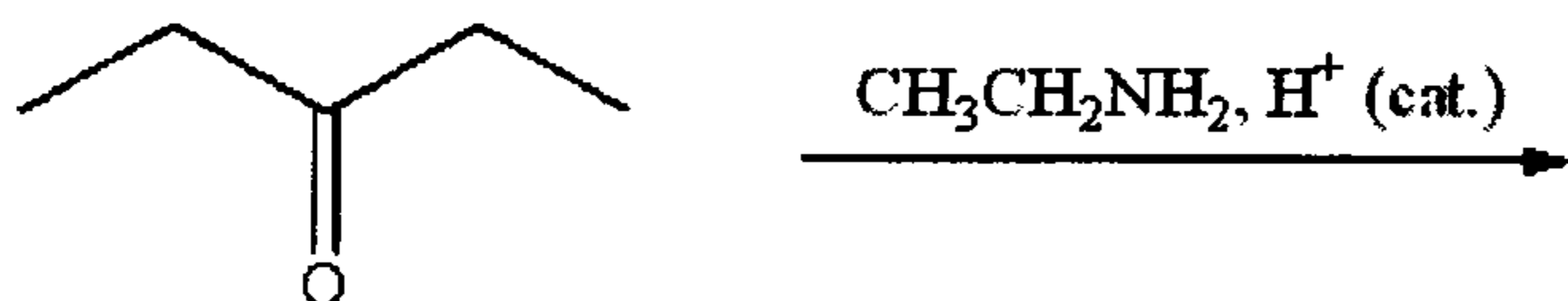
10. Provide the IUPAC name for the organic compound below.



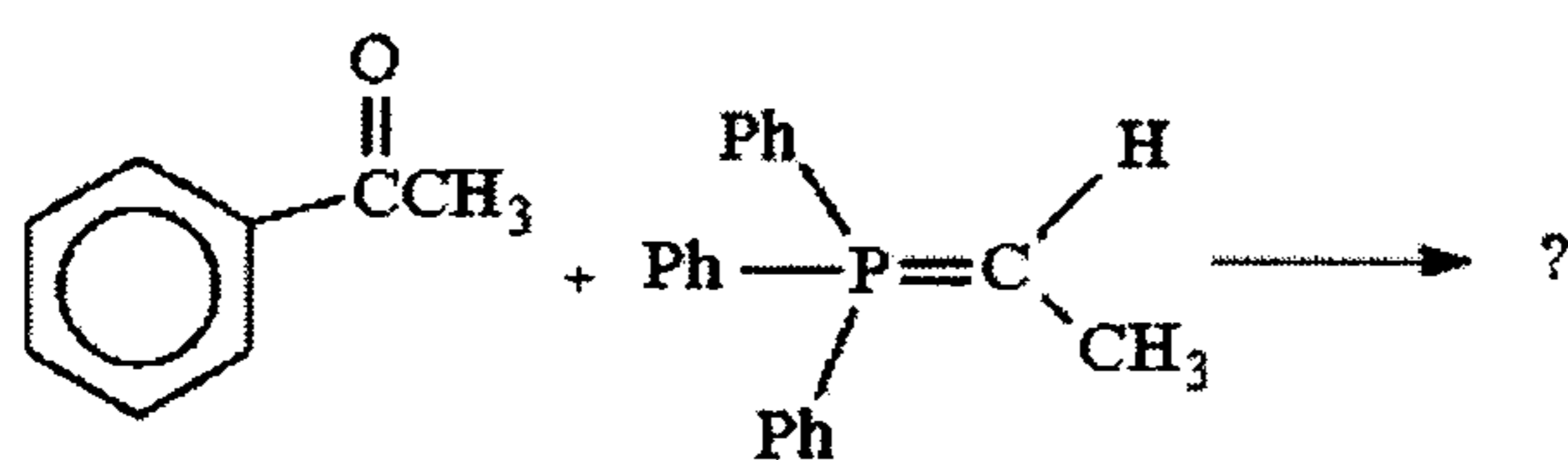
11. Provide the major organic product of the following.



12. Provide the major organic product of the following.



13. Give the products obtained from the following Wittig reaction. Show both stereoisomers.



14. Arrange the following alcohols in the order of increasing reactivity toward acid-catalyzed dehydration

1-Hexanol 2-Methyl-2-pentanol 3-Methyl-2-pentanol

15. A compound R ($C_9H_{10}O$) gives a positive iodoform test; its IR spectrum shows a strong peak at 1750 cm^{-1} . The ^1H NMR spectrum of R gives the following:

Singlet $\delta 2.0$ (3H), Singlet $\delta 3.5$ (2H), Multiple $\delta 7.1$ (5H)

Give a structure for compound R and make assignments for each of the NMR peaks.