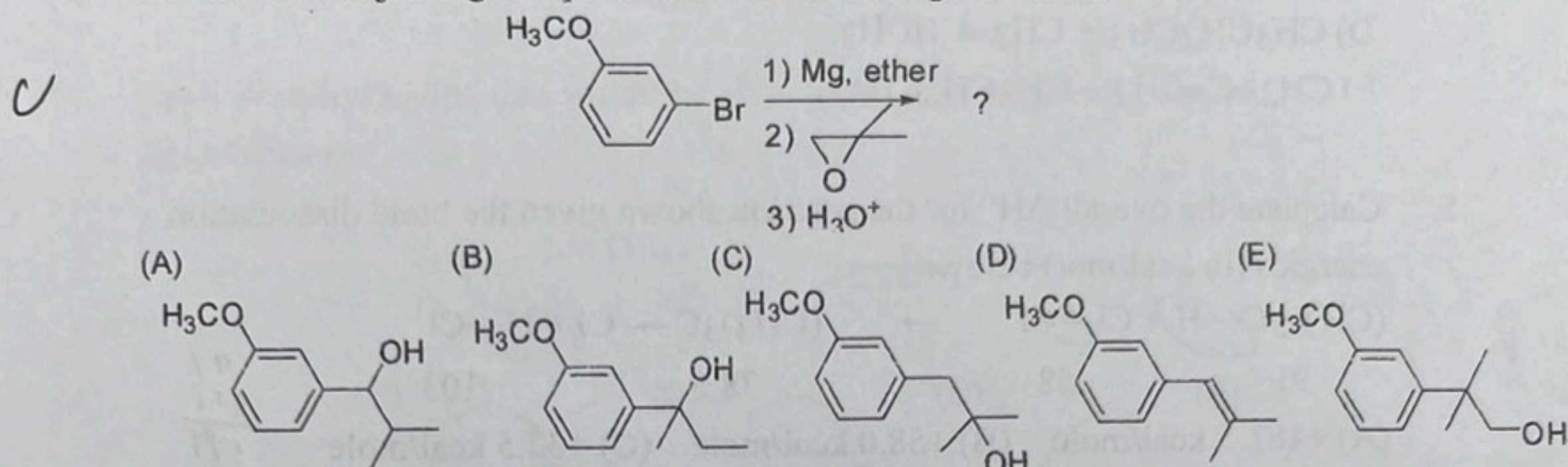


Organic chemistry (II) first term exam 3/31/2023 (Fri.)

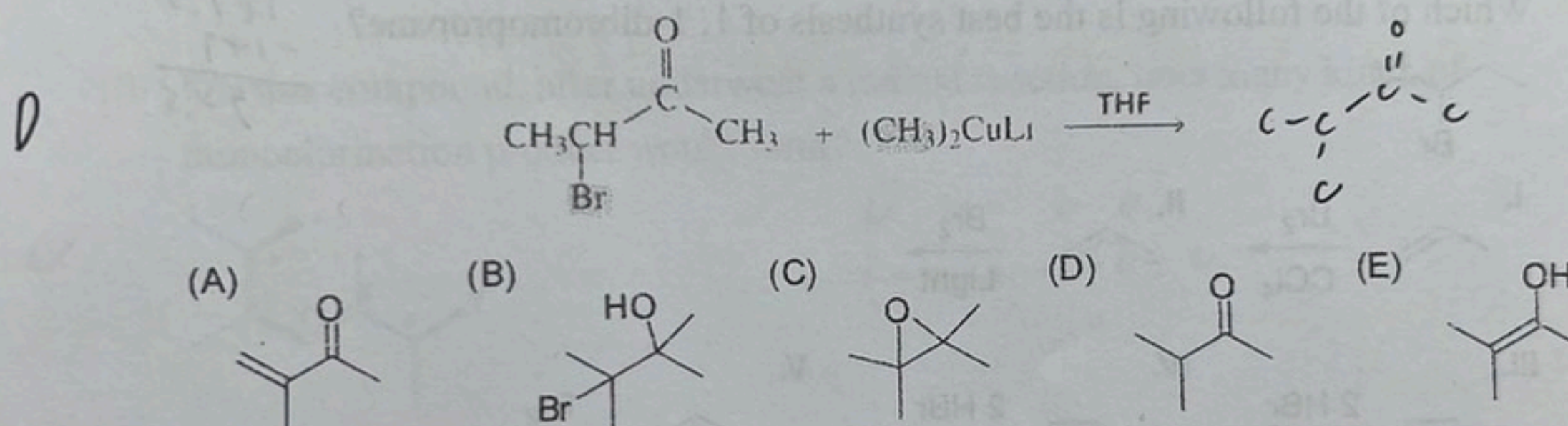
Name: _____ ; Student ID number: 110017060; Score: _____ /300

I. Multiple choice (5 points each, 105 points total)

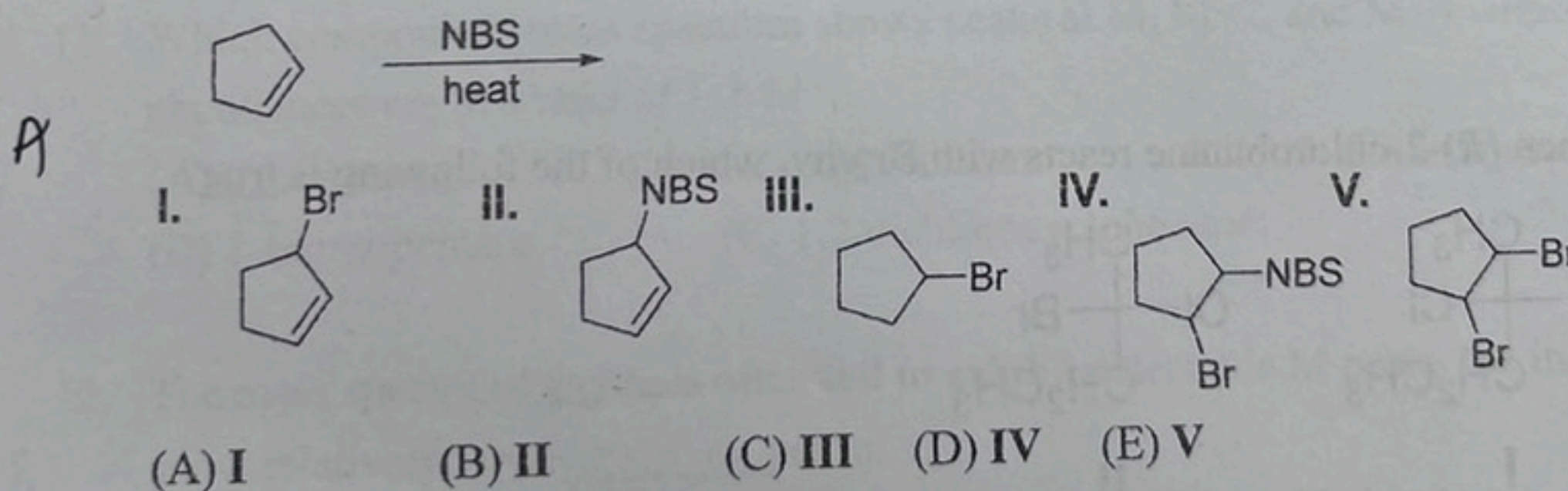
1. Provide the major organic product of the following reactions.



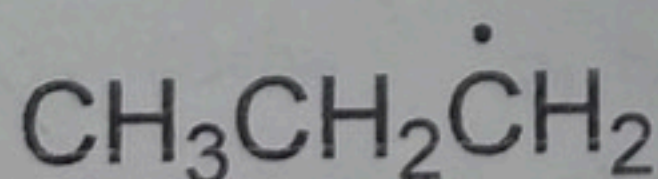
2. What is the major product of the following reaction?



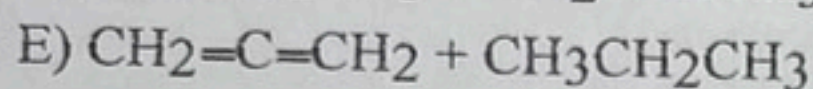
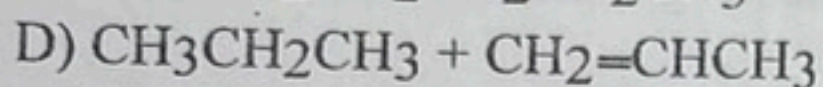
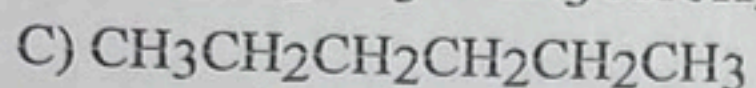
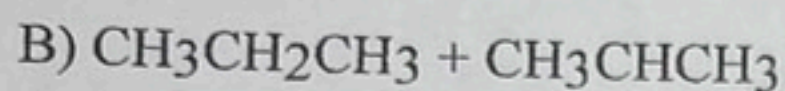
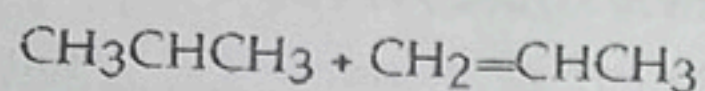
3. What is the major product of the following reaction?



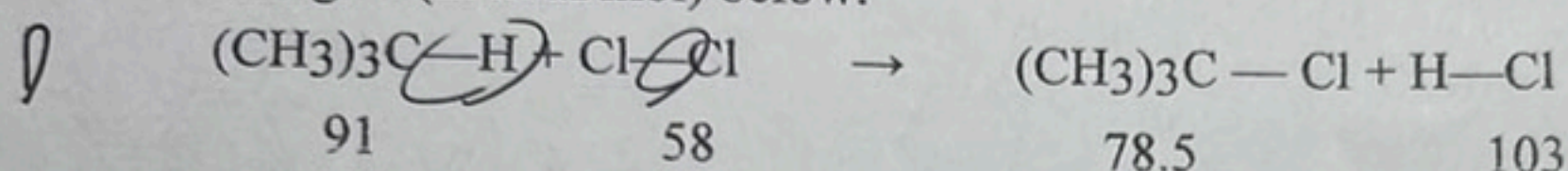
4. Which of the following products result from the disproportionation reaction between two propyl radicals?



A)



5. Calculate the overall ΔH° for the reaction shown given the bond dissociation energies (in kcal/mol) below:

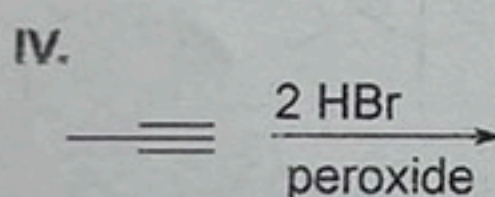
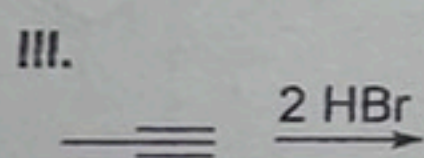
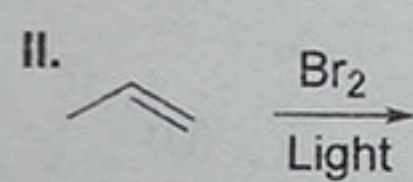
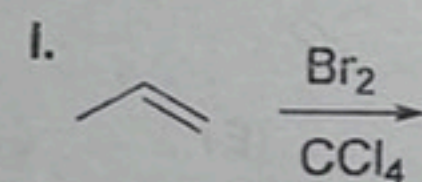
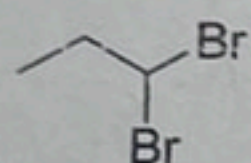


- (A) +181.5 kcal/mole (B) +58.0 kcal/mole (C) +32.5 kcal/mole
 (D) -32.5 kcal/mole (E) -57.5 kcal/mole

$$\begin{array}{r} 91 \\ + 58 \\ \hline 149 \end{array}$$

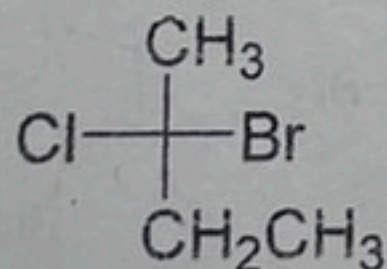
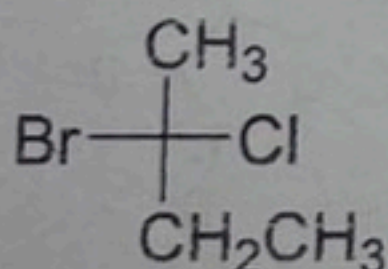
$$\begin{array}{r} 78.5 \\ + 103 \\ \hline 181.5 \\ - 149 \\ \hline 32.5 \end{array}$$

6. Which of the following is the best synthesis of 1, 1-dibromopropane?



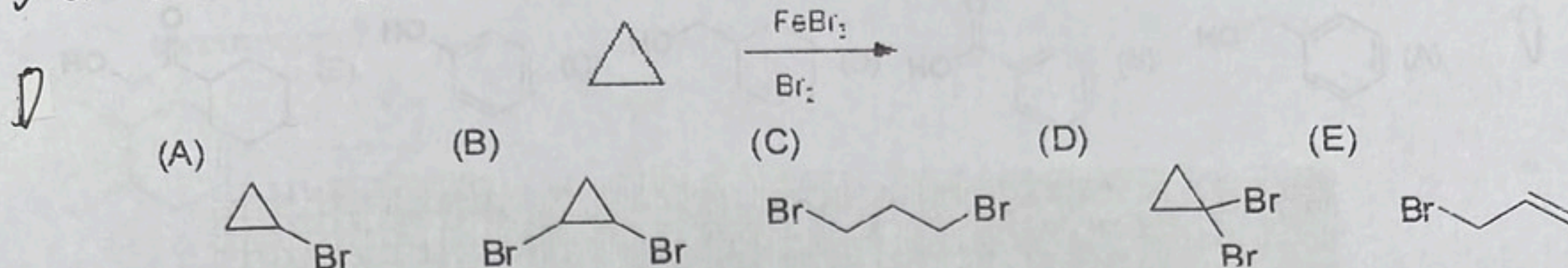
- (A) I. (B) II. (C) III. (D) IV. (E) V.

7. When (*R*)-2-chlorobutane reacts with $\text{Br}_2/h\nu$, which of the following is true?

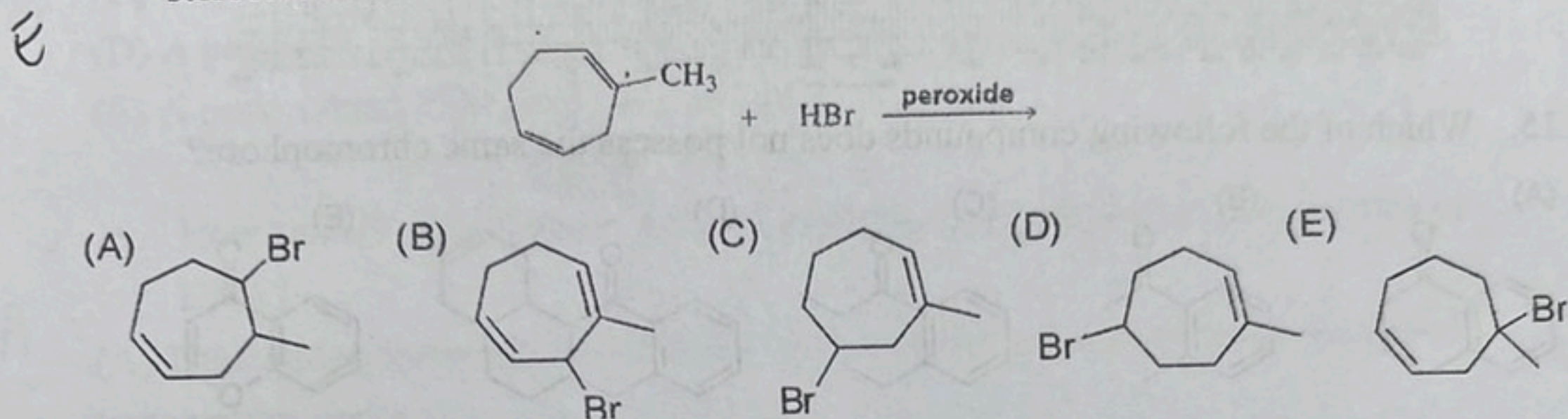


- (A) Only I is formed.
 (B) Only II is formed.
 (C) Both I and II are formed in equal amounts.
 (D) Both I and II are formed in unequal amounts.
 (E) Both I and II could never form under these conditions.

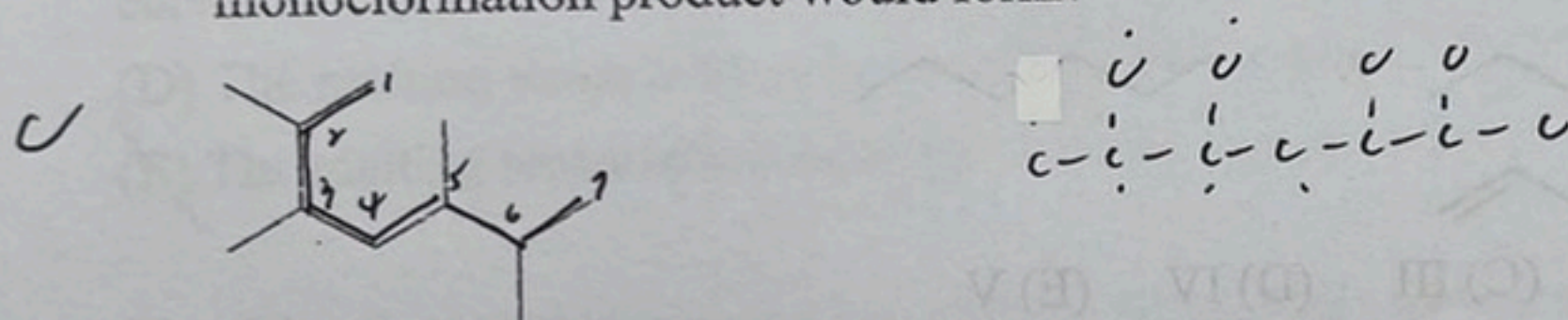
✓ 8. Give the best product for the reaction.



9. Draw the alkyl halide that would be obtained in greatest yield. Include stereoisomers.



10. For this compound, after underwent a radical reaction, how many kinds of monochlorination product would form?



- (A) 3 (B) 4 (C) 5 (D) 6 (E) 9

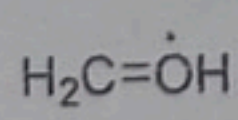
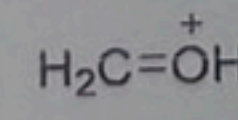
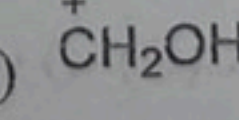
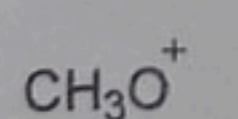
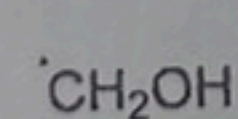
11. Which compound's mass spectrum shows peaks at M, M+2, and M+4 whose abundances are in a ratio of 1:2:1?

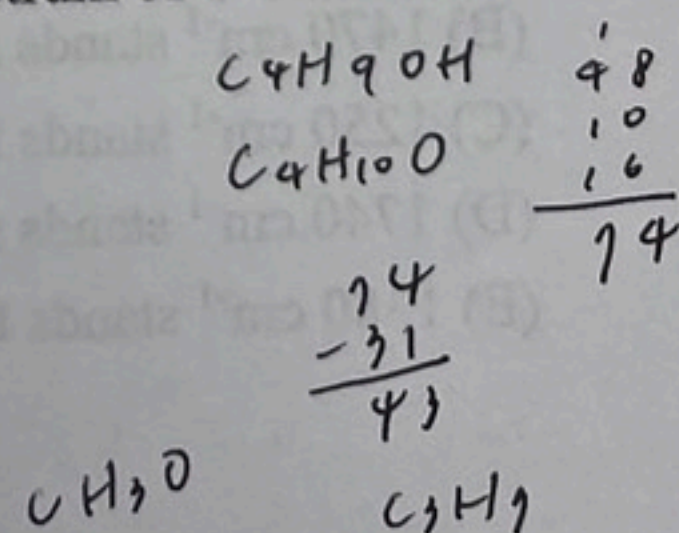
- (A) cyclohexanol (B) chlorocyclohexane (C) 1,5-dibromopentane
 (D) 1-bromopentane (E) 1,2-dichlorocyclohexane

12. The mass spectra of alcohols often fail to exhibit detectable M peaks but instead show relatively large _____ peaks.

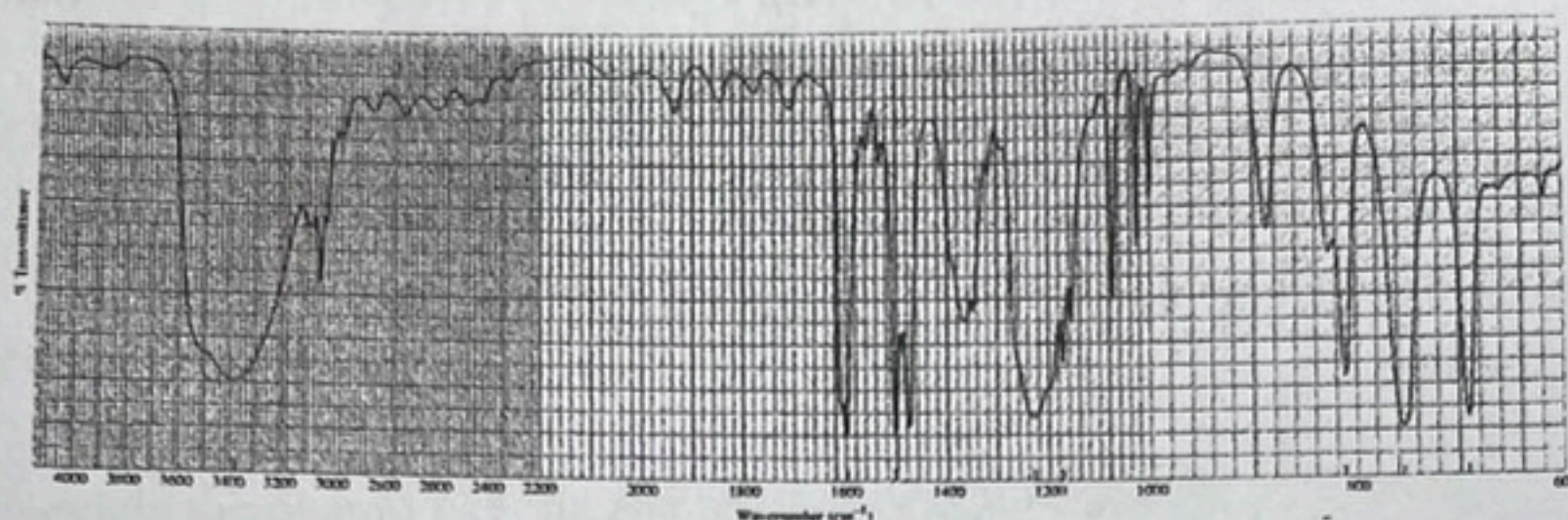
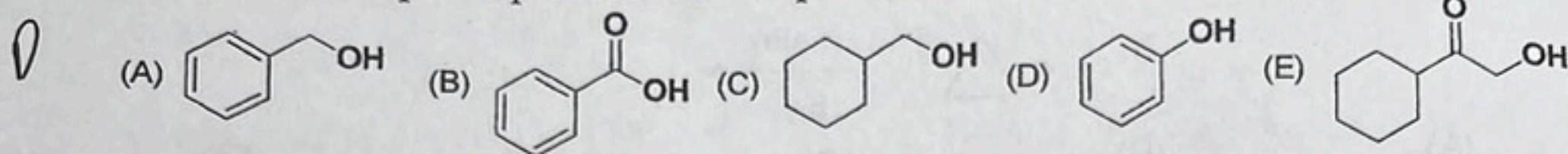
- (A) M+1 (B) M-18 (C) M-16 (D) M-17 (E) M+2

13. Give the ion that corresponds a m/z ratio of 31 in a mass spectrum of 1-butanol.

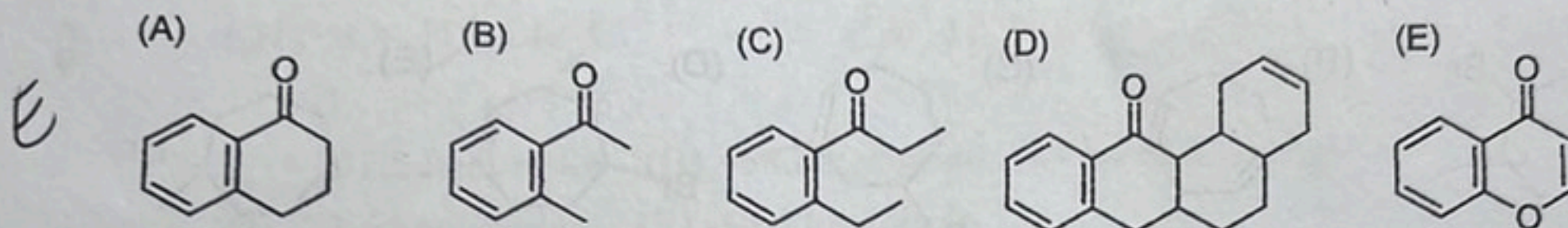
- (A)  (B)  (C) 
 (D)  (E) 



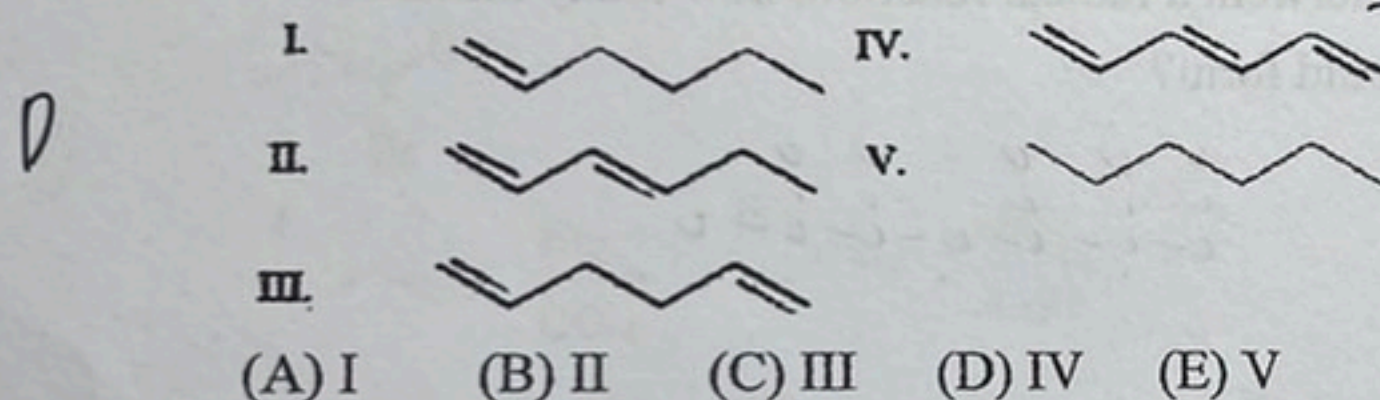
14. Which compound produced the IR spectrum shown below?



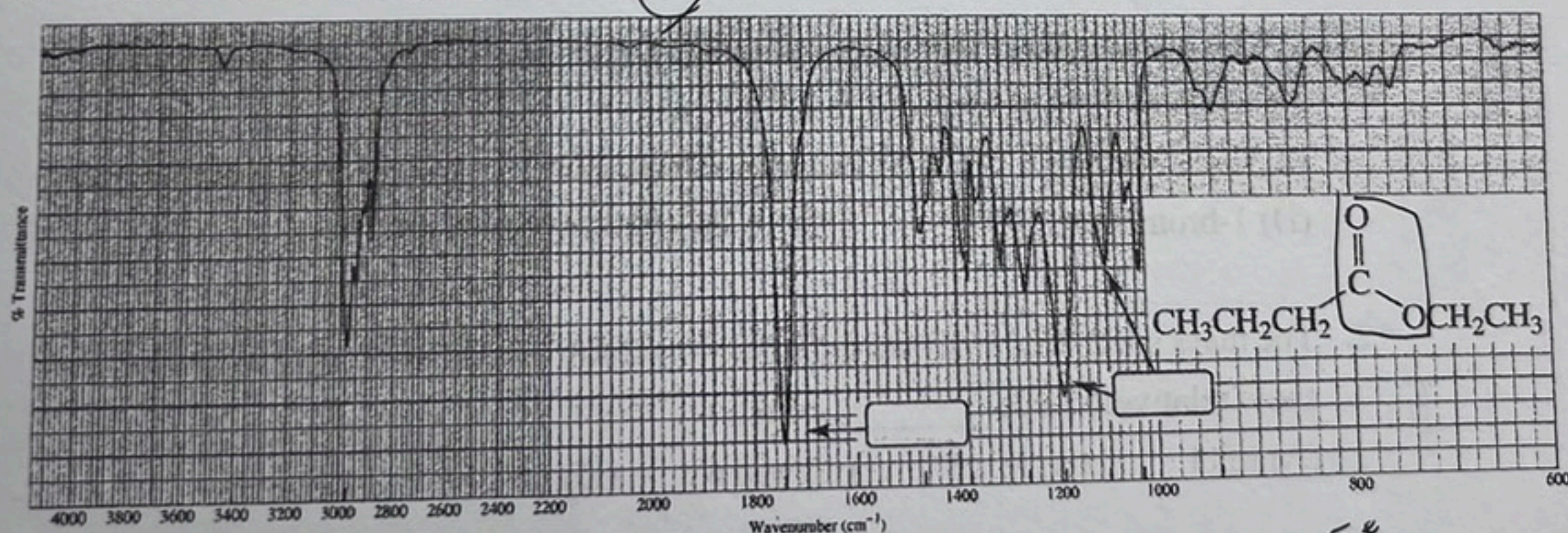
15. Which of the following compounds does not possess the same chromophore?



16. Which of the following compounds exhibits the highest λ_{max} in UV spectra?

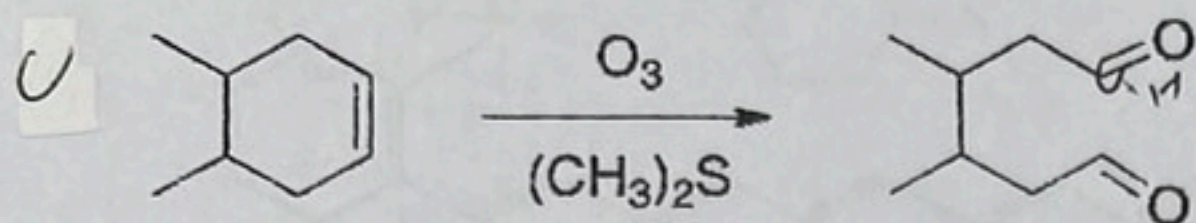


17. Which the following assignment is **not** correct?



- (A) 1050 cm^{-1} stands for ester C(O)-O stretching
 (B) 1470 cm^{-1} stands for CH_2 bending
 (C) 1250 cm^{-1} stands for ester C(O)-O stretching
 (D) 1740 cm^{-1} stands for ester C=O stretching
 (E) 1380 cm^{-1} stands for CH_3 bending

18. How would you verify the completion of the following reaction by IR spectroscopy?



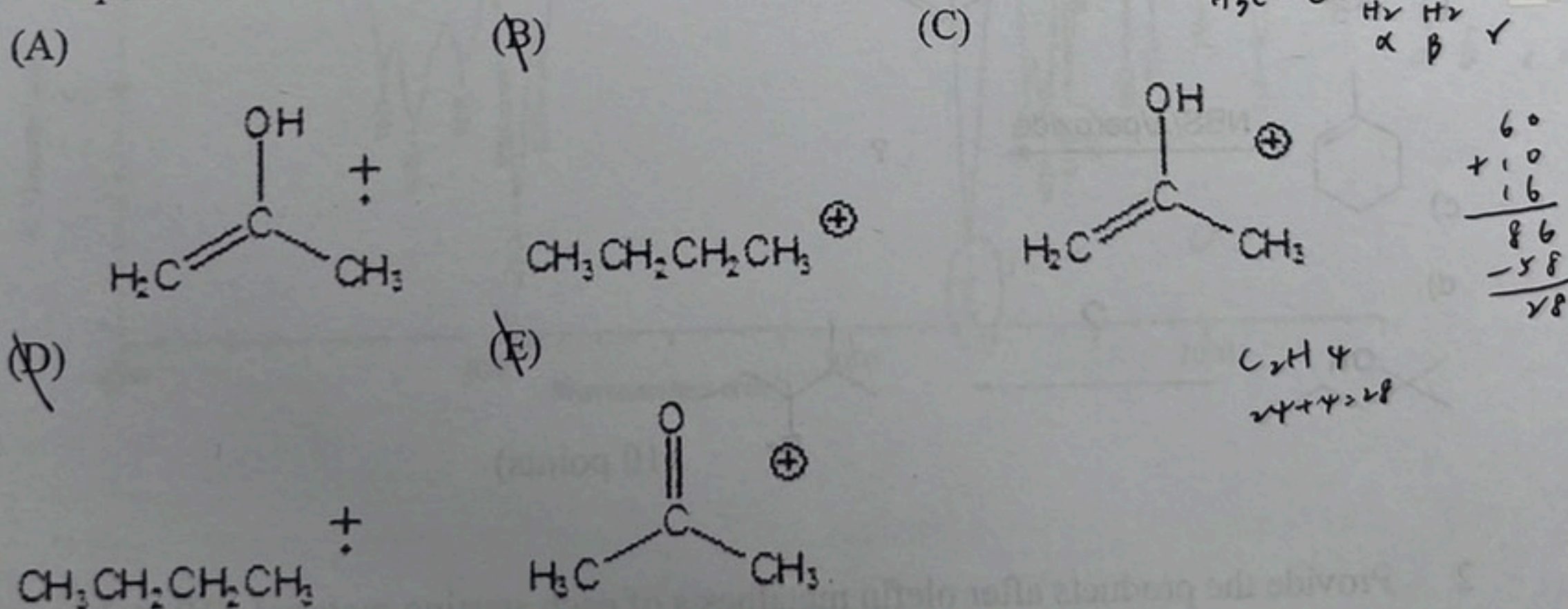
- (A) A peak due to C=O stretch between 1680-1600 cm^{-1} should appear.
 (B) A new intense peak around 1720 cm^{-1} corresponding to C=C stretch should disappear.
 (C) Two new peaks appear at 2820 and 2720 cm^{-1} .
 (D) A peak around 1460 cm^{-1} should disappear.
 (E) A peak around 1380 cm^{-1} should appear.
- ✓ 19. How can UV spectroscopy be used to estimate the nucleotide composition of DNA?

A

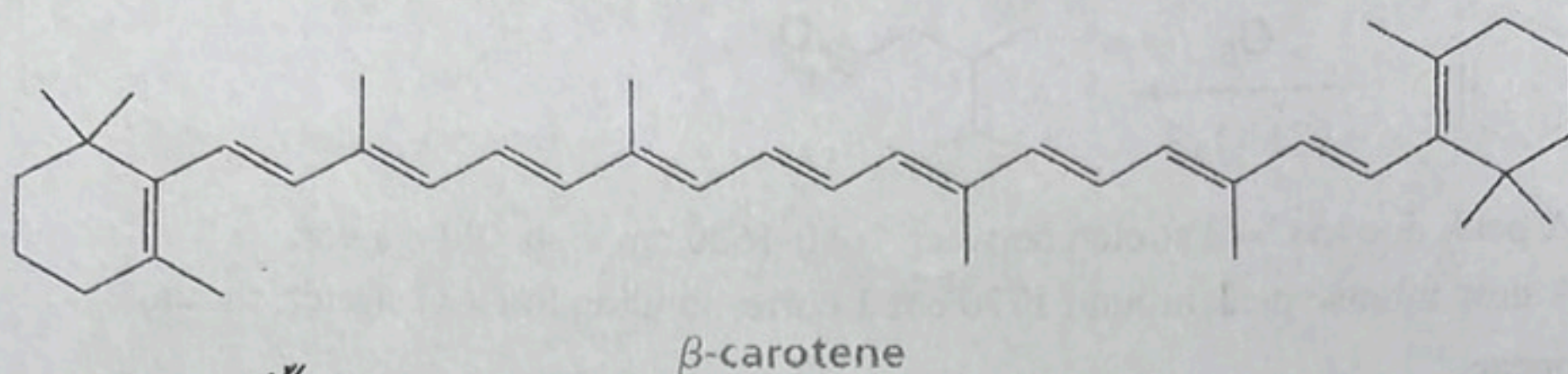
- (A) The melting temperature of DNA is the end point of an absorbance-versus-temperature curve.
 (B) The melting temperature increases with the number of A-T base pairs.
 (C) The melting temperature of DNA is the midpoint of an IR-versus-temperature curve.
 (D) The melting temperature increases with the number of G-C base pairs.
 (E) The melting temperature increases with the number of A-U base pairs.

20. Give the ion that corresponds to a m/z ratio of 58 in a mass spectrum of 2-pentanone.

A



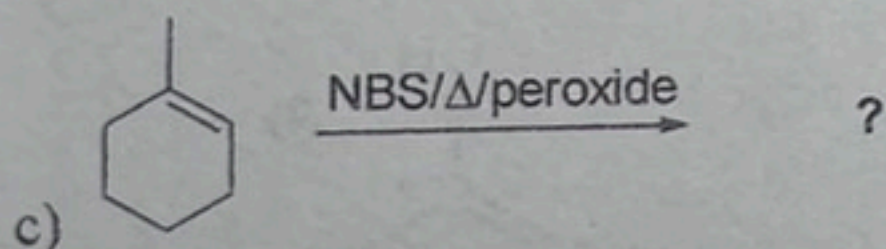
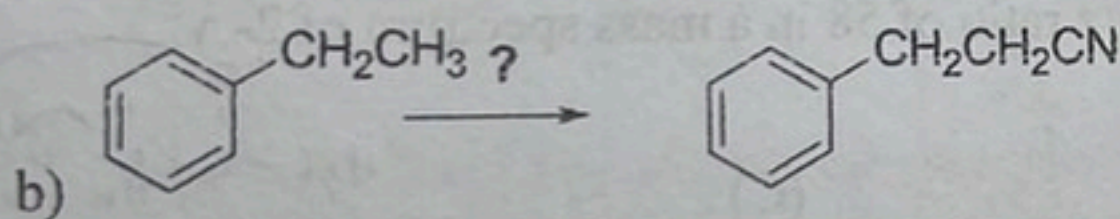
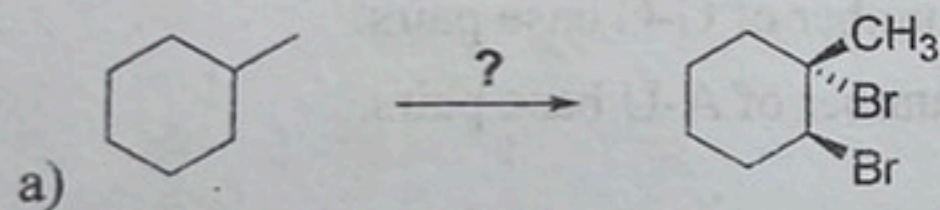
21. The structure of β -carotene is shown below. What is the structure feature of Astaxanthin (蝦紅素, $C_{40}H_{52}O_4$)



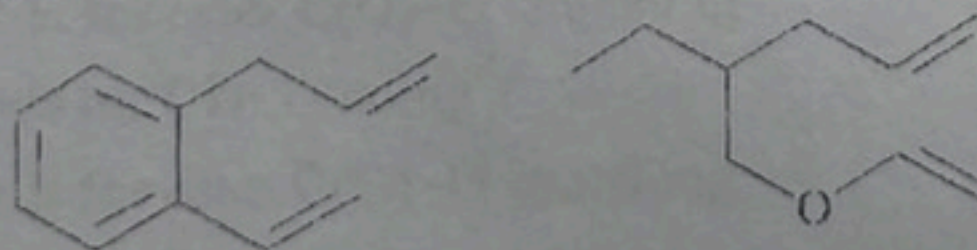
- (A) With an ester group in each one of the six-membered ring.
 (B) With a ketone and a hydroxy group in each one of the six-membered ring.
 (C) With an epoxide group in each one of the six-membered ring.
 (D) With an ether group in each one of the six-membered ring.
 (E) With an acid group in each one of the six-membered ring.

II. Provide suitable names, structure(s), reagent(s), or explanation(s) for the following questions. (total points 155)

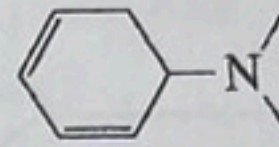
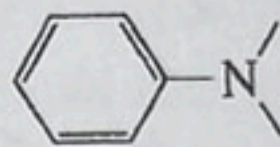
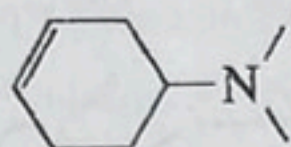
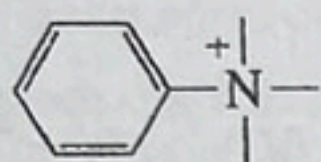
1. Provide the suitable synthetic routes, reagents or product for the following reactions: (each 5 points, total 25 pts)



2. Provide the products after olefin metathesis of each starting material. (10 pts)

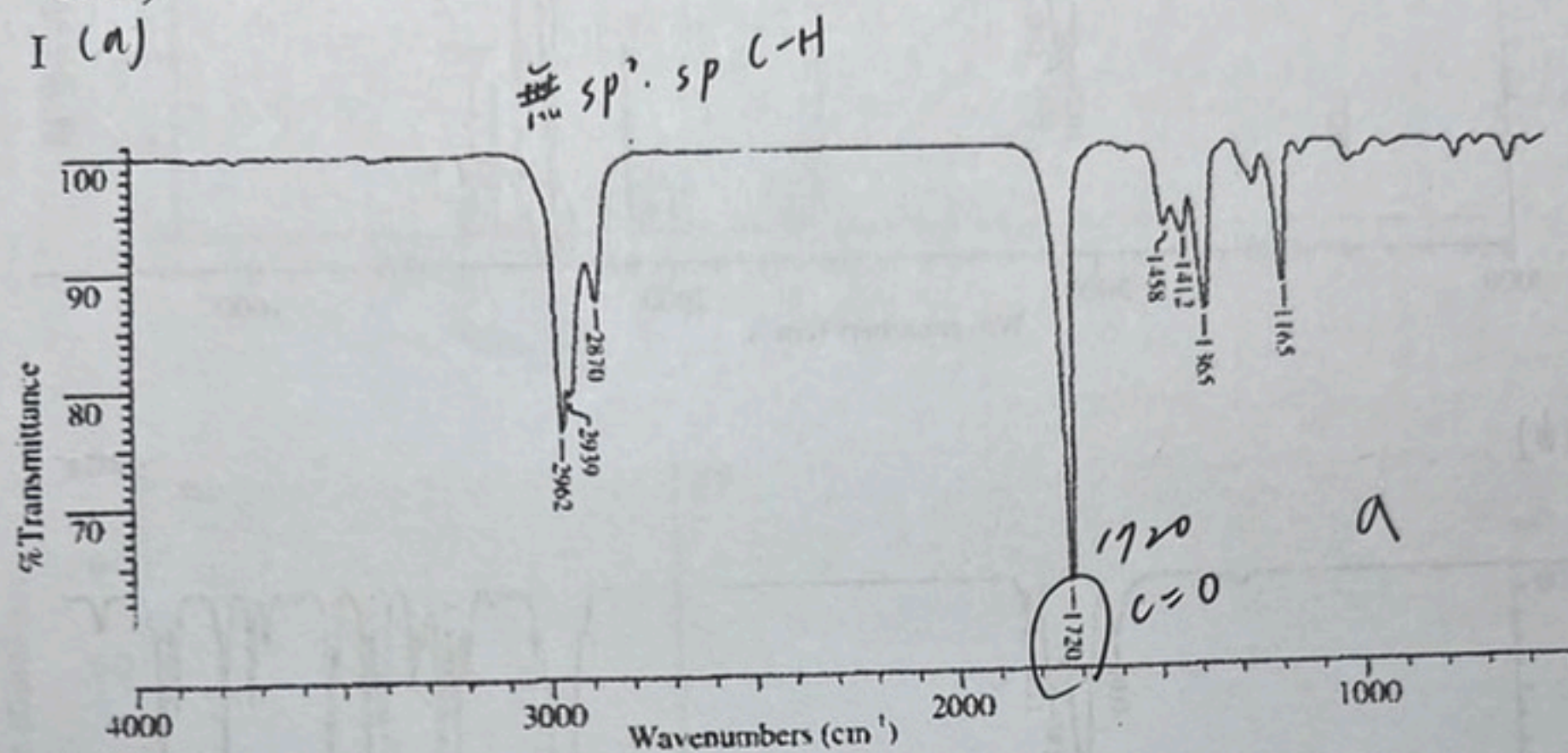


3. Rank each set of compounds in order of decreasing λ_{max} : (10 pts)



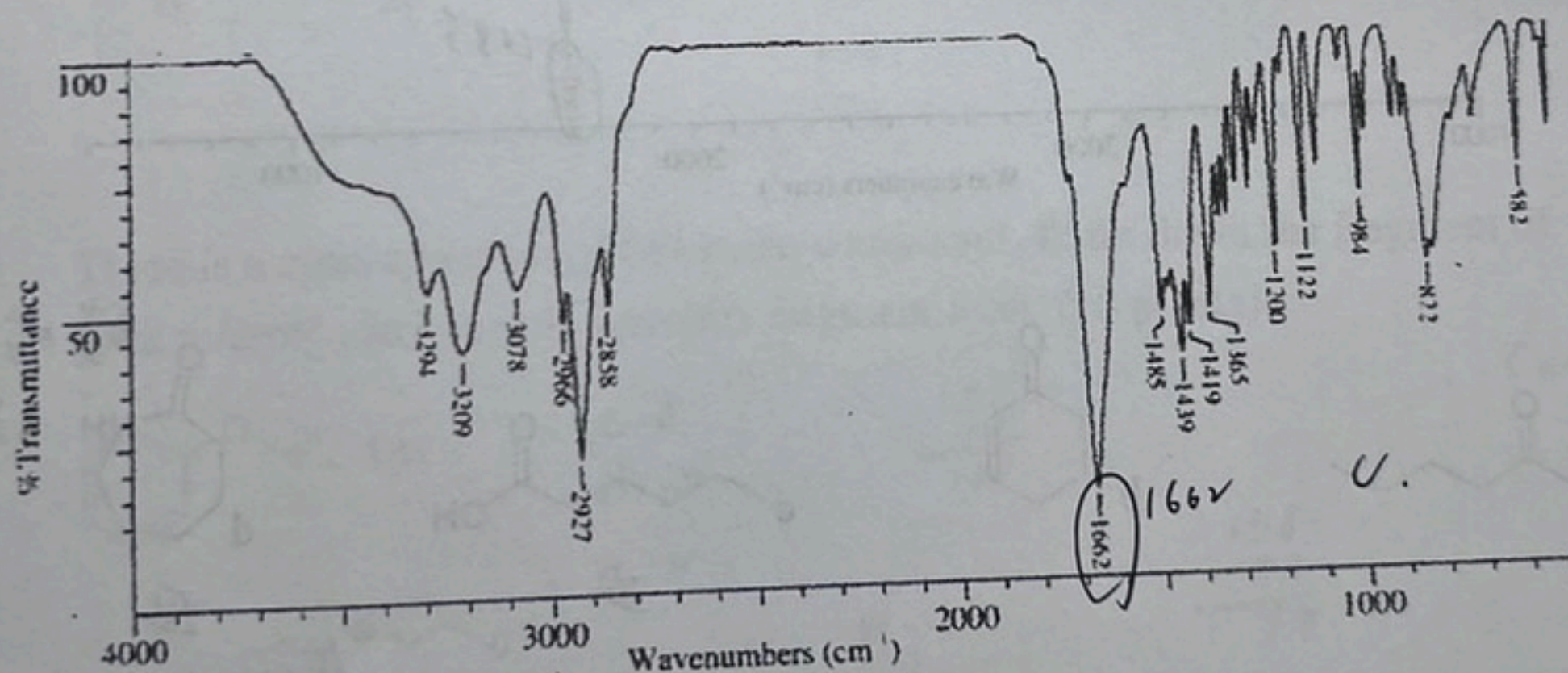
4. Match the structure of each compound to the following IR spectra. (5 points each)

I (a)



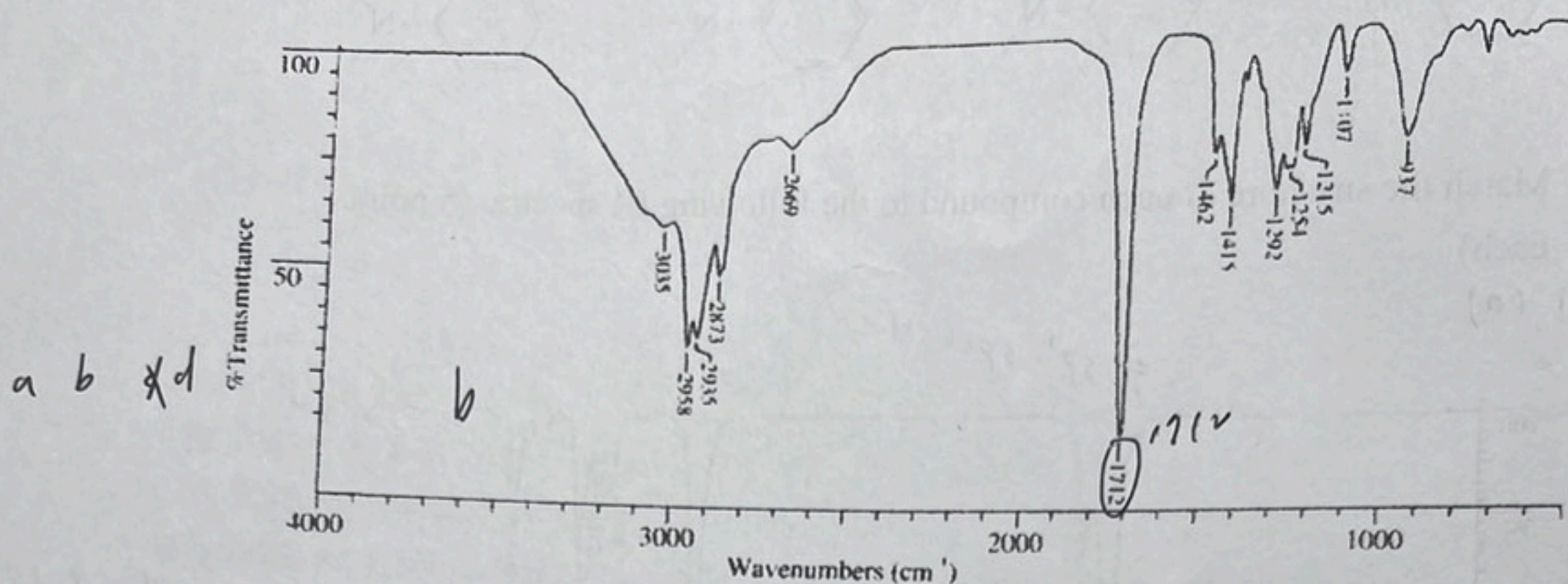
a b c d

II (d)

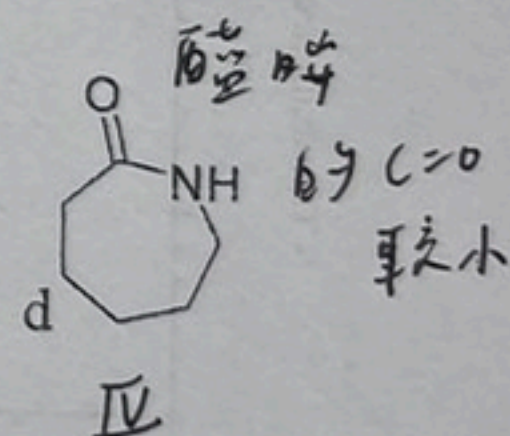
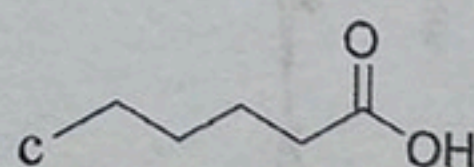
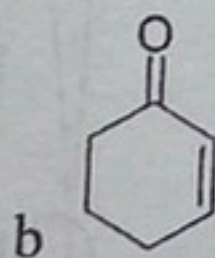
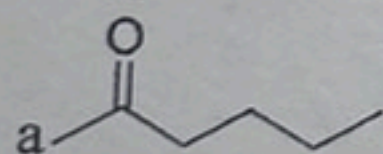
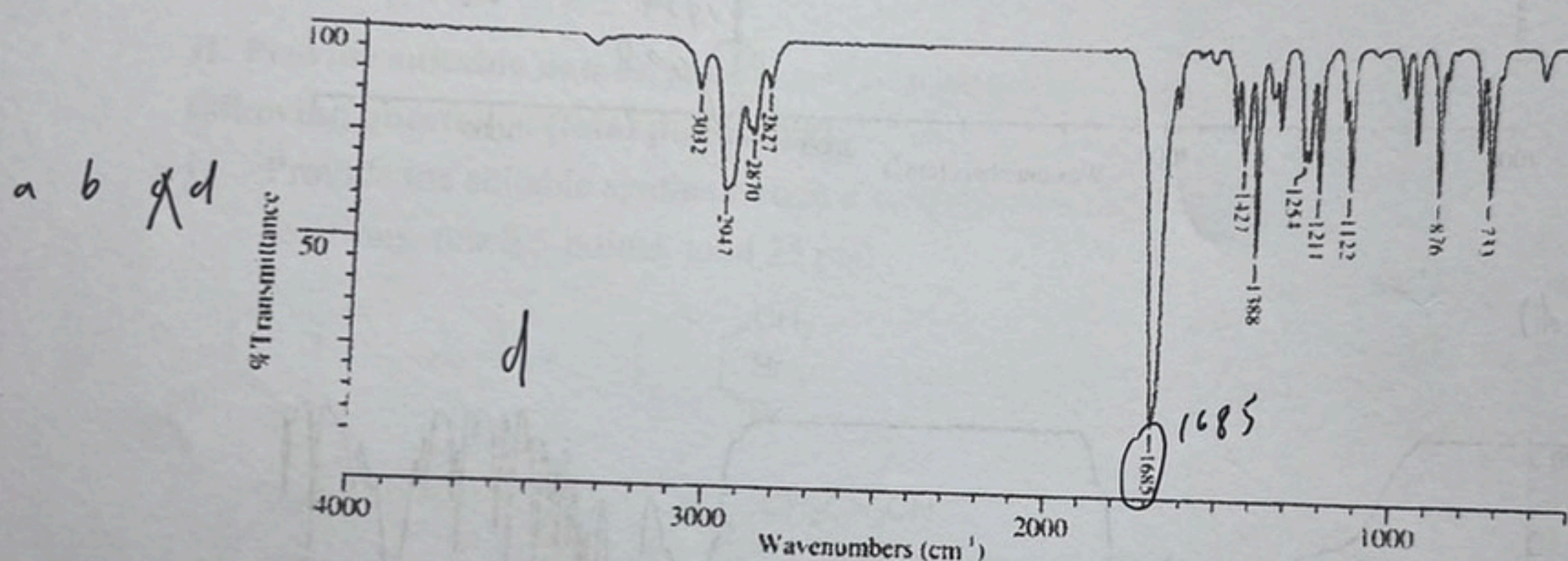


a b c d

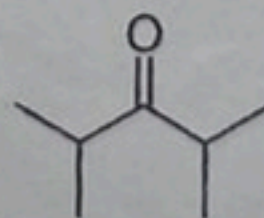
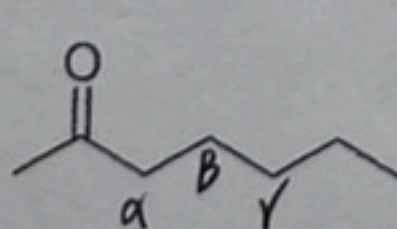
III (c)



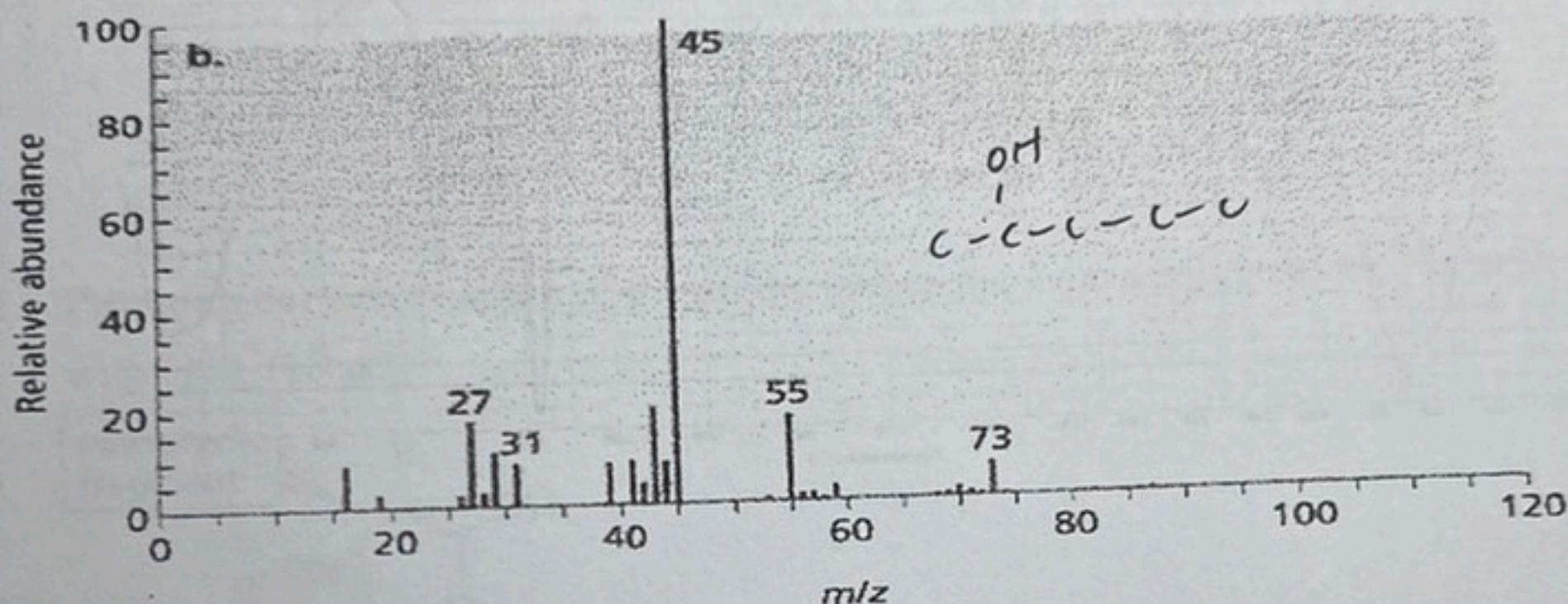
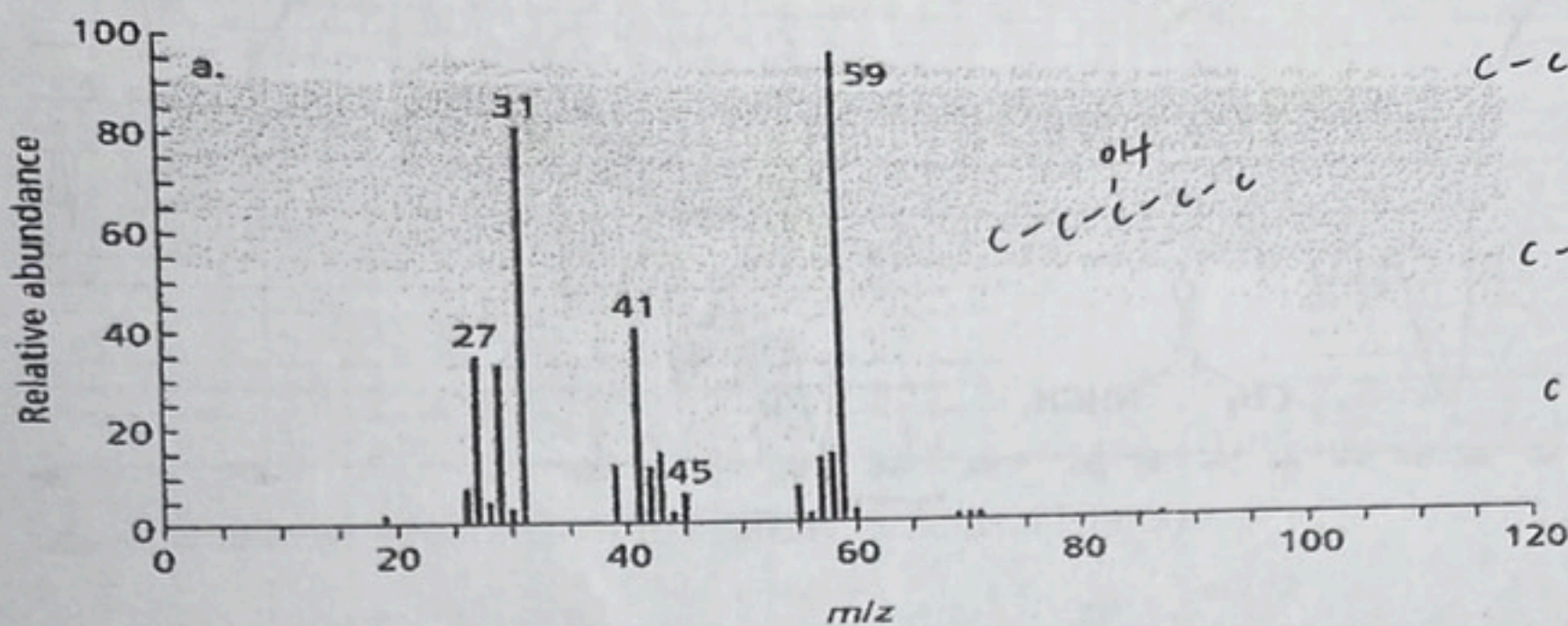
IV (b)



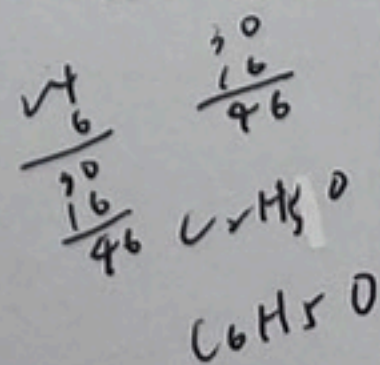
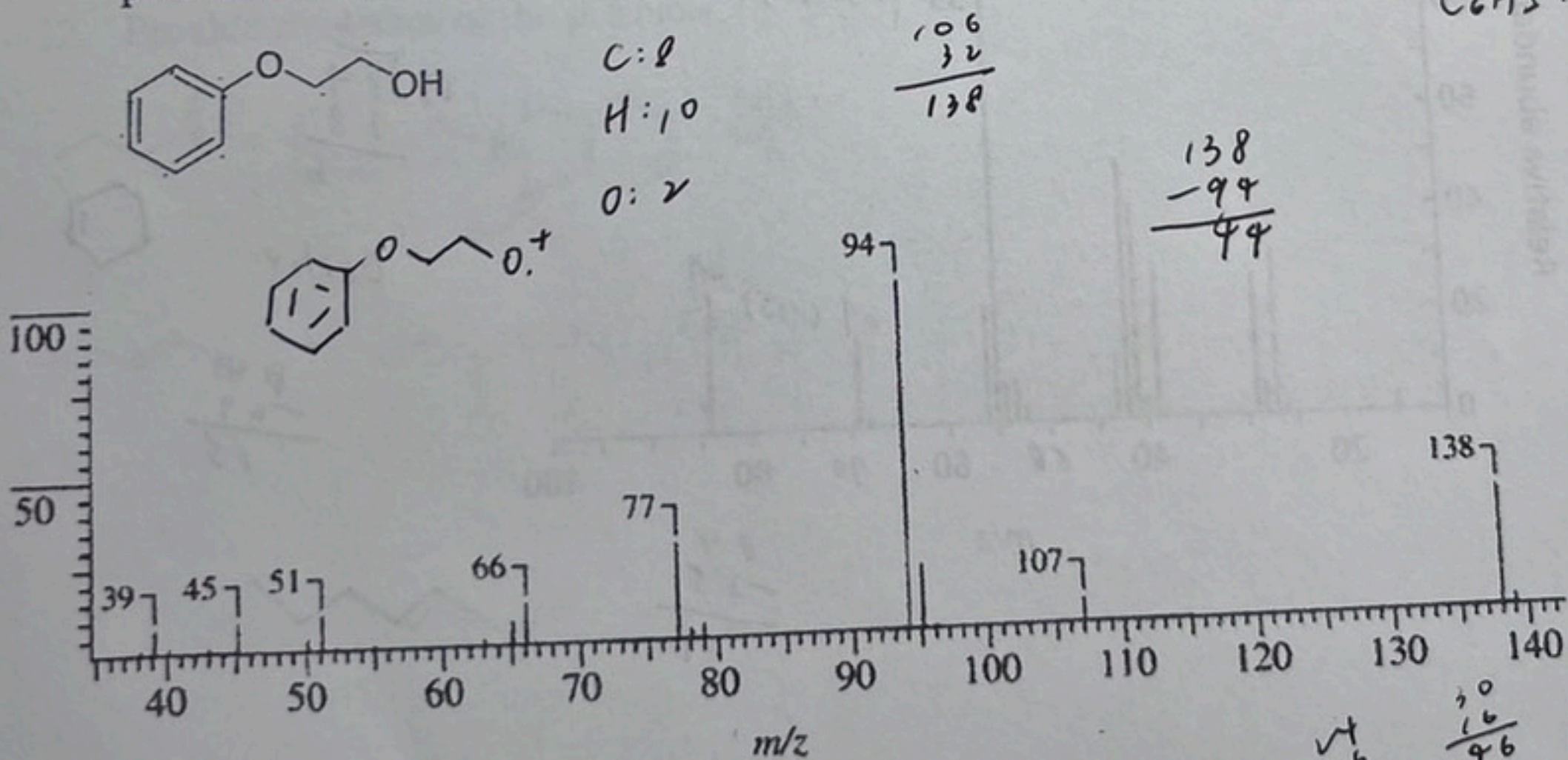
5. Draw the mechanism for formation of the fragments you would expect to see in the mass spectrum of each of the following compounds: (10 point)



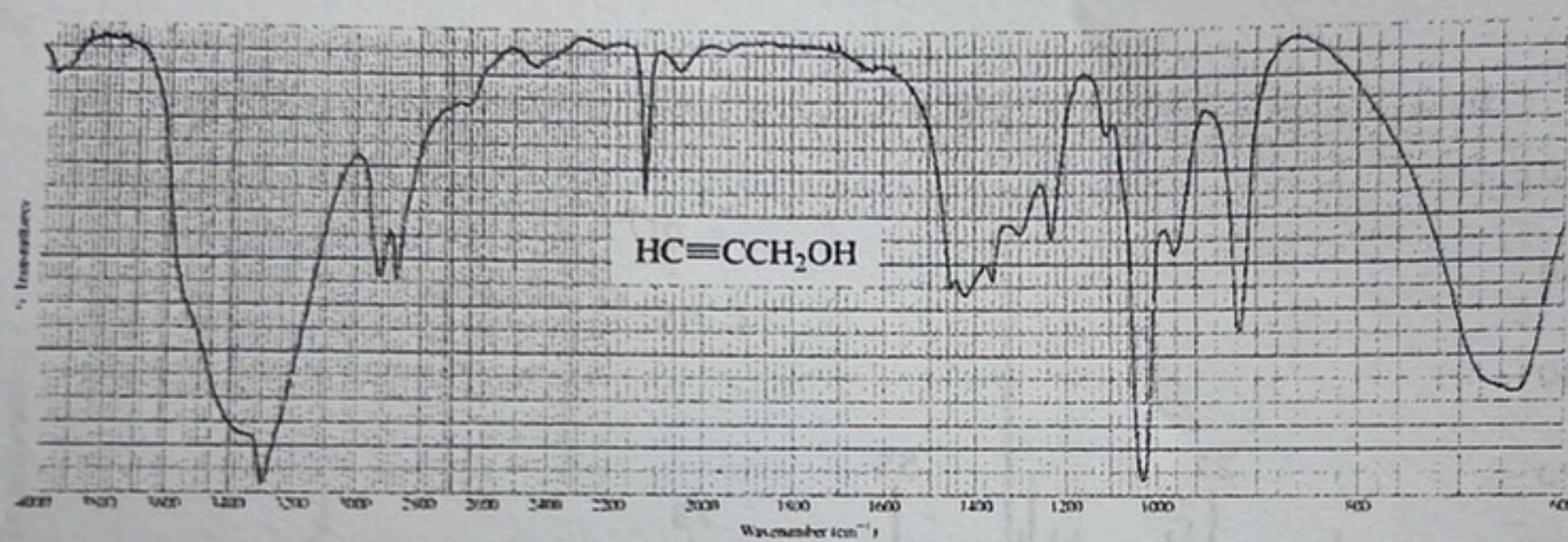
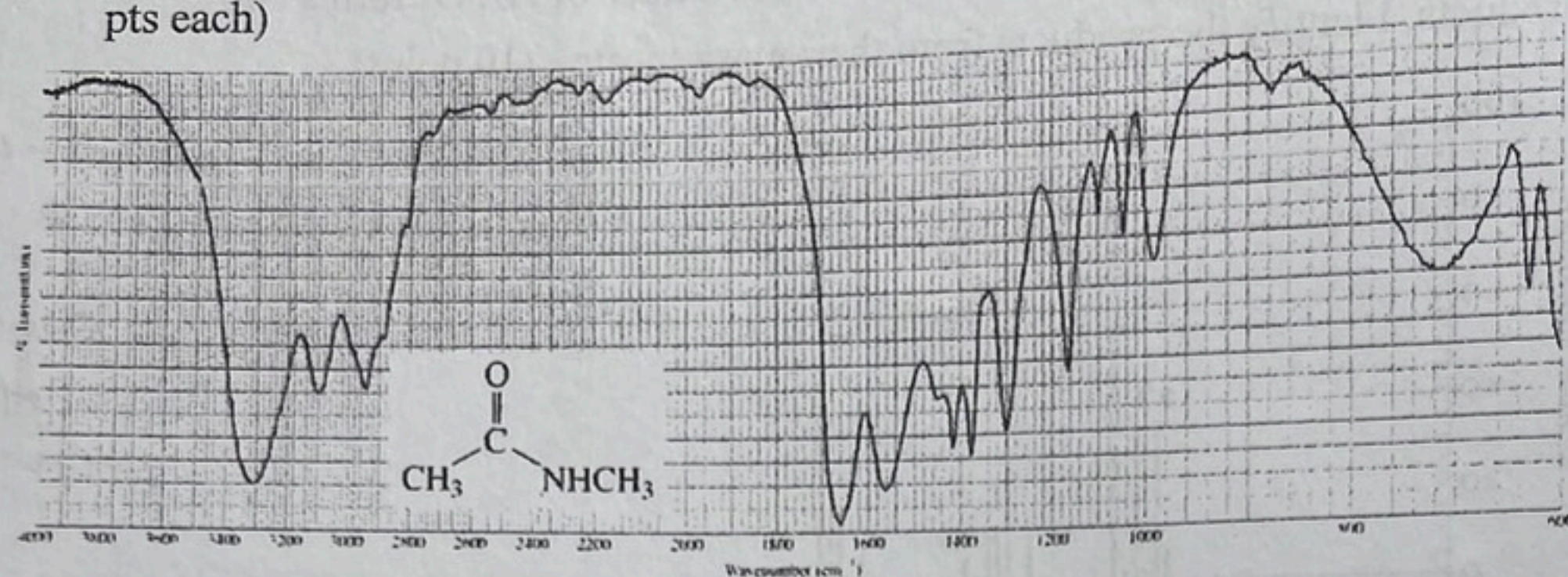
6. The reaction of (Z)-2-pentene with water and a trace of H_2SO_4 forms two products. Identify the products from their mass spectra. (10 point)



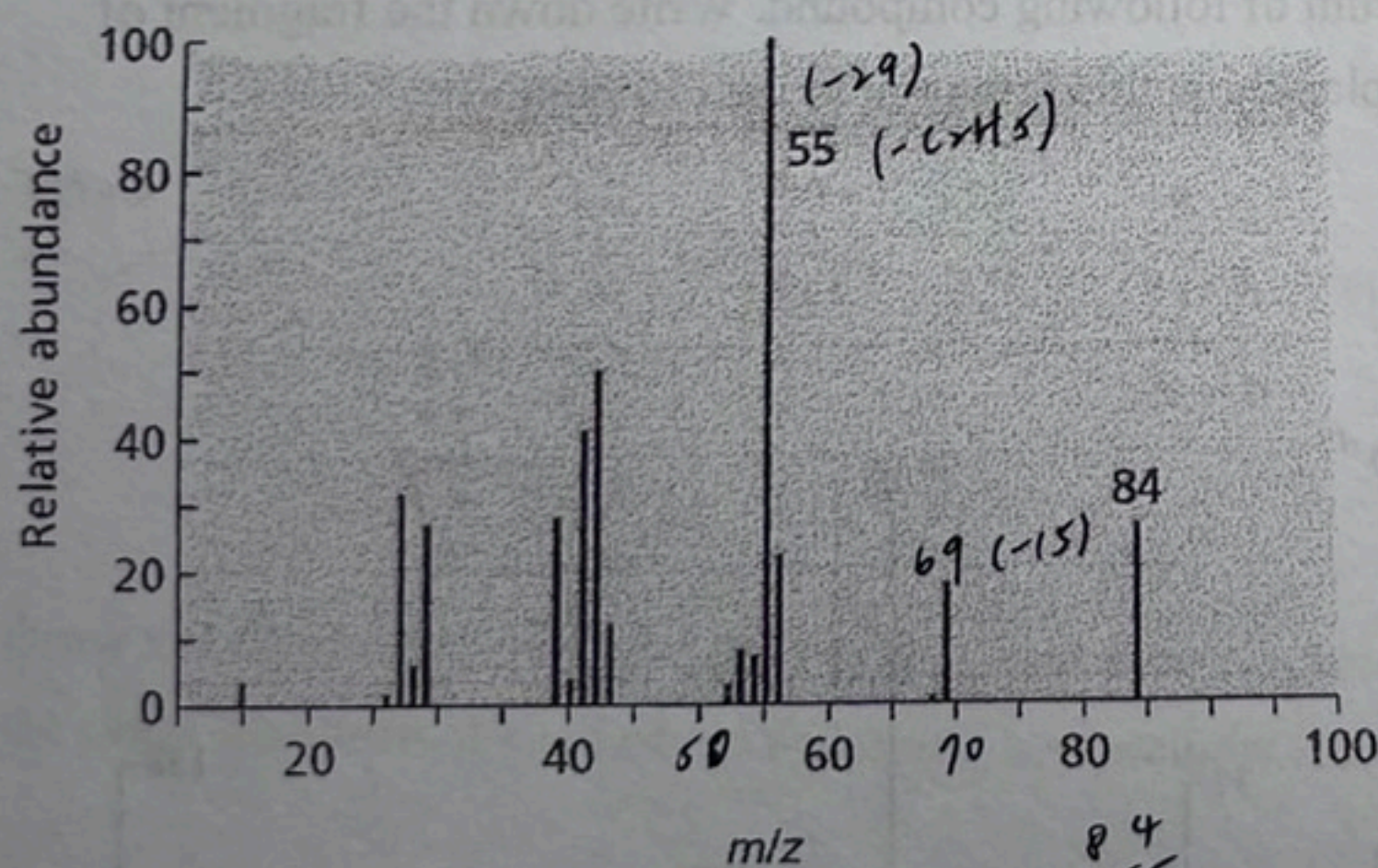
- ✓ 7. There is a mass spectrum of following compound. Write down the fragment of peak $m/z=94$, and explain how this fragment form. (10 points)



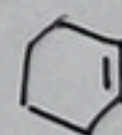
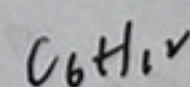
8. Identify the four characteristic stretching modes of the following IR spectra (10 pts each)



- ✓ 9. Identify the compound that gives the mass spectrum and infrared spectrum shown here. (10 pts)



$$\begin{array}{r} 6 \\ 13 \overline{) 84} \\ \underline{78} \\ 6 \end{array}$$



$$\begin{array}{r} 84 \\ -69 \\ \hline 15 \end{array}$$

$$\begin{array}{r} 84 \\ -55 \\ \hline 29 \end{array}$$

