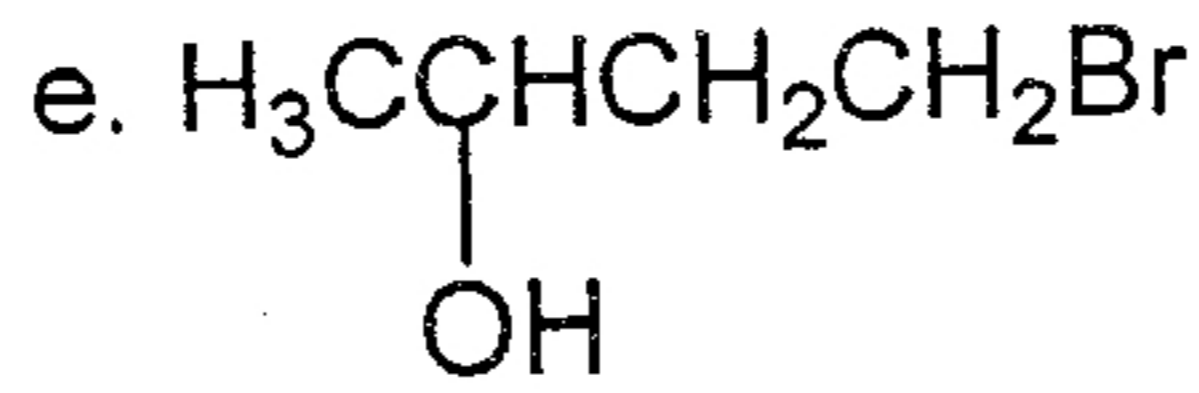
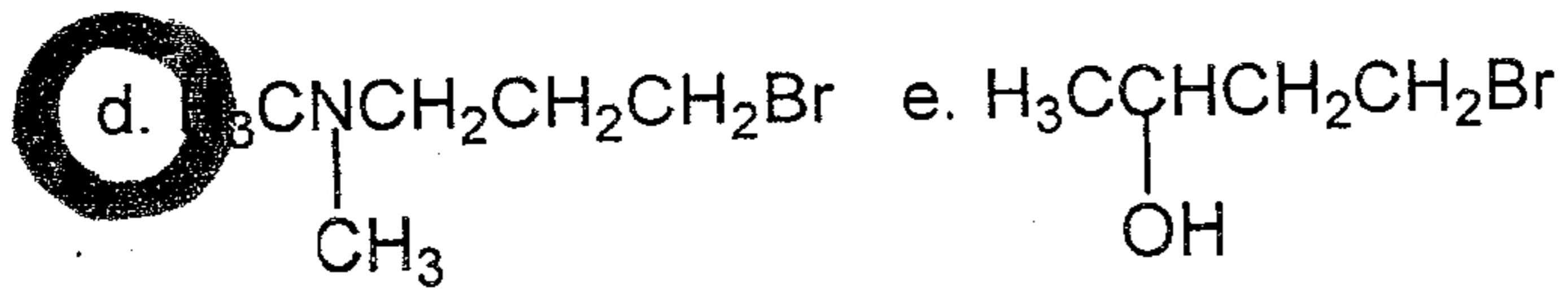
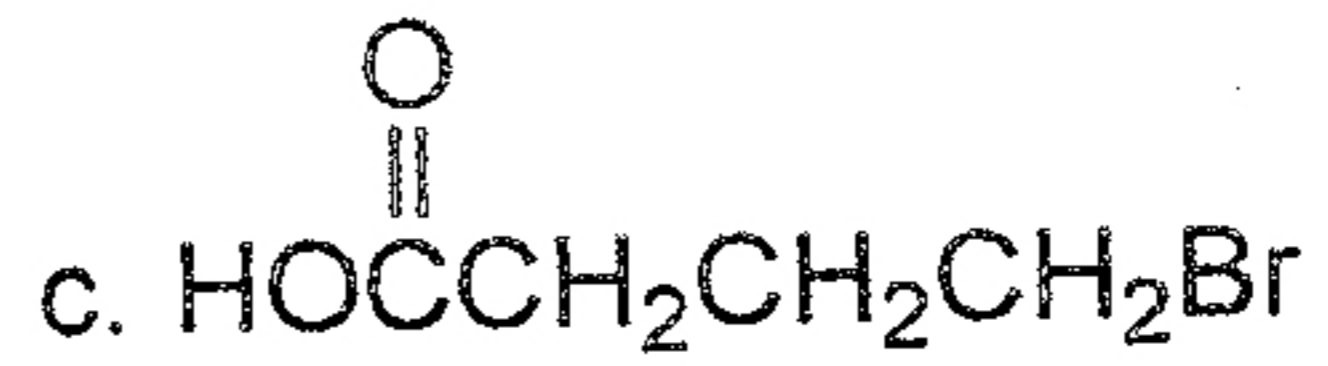
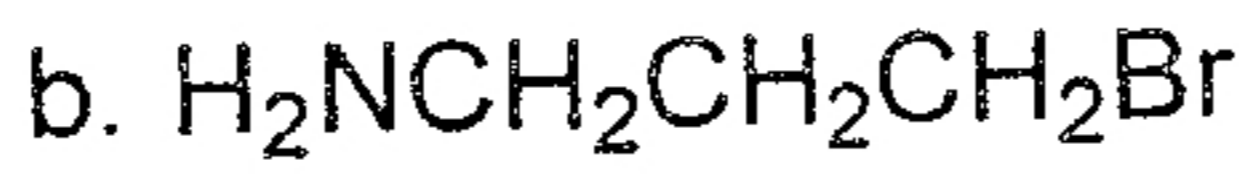
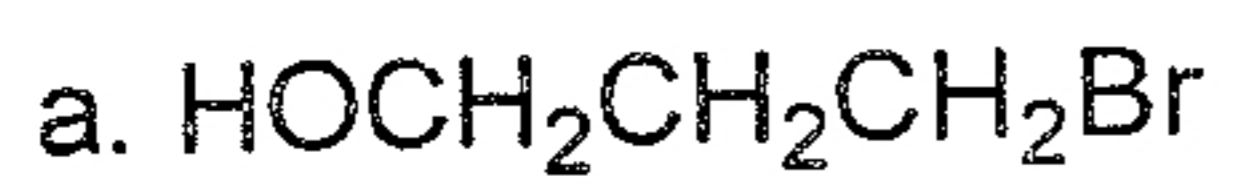


Test 1

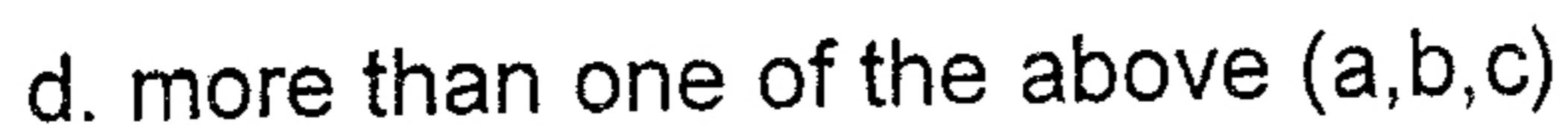
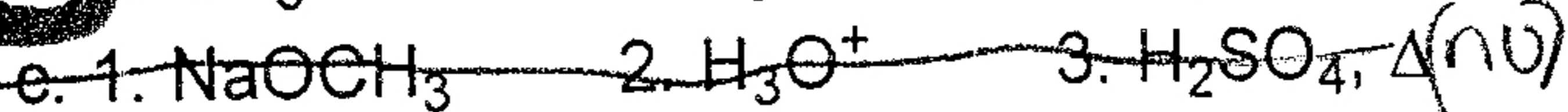
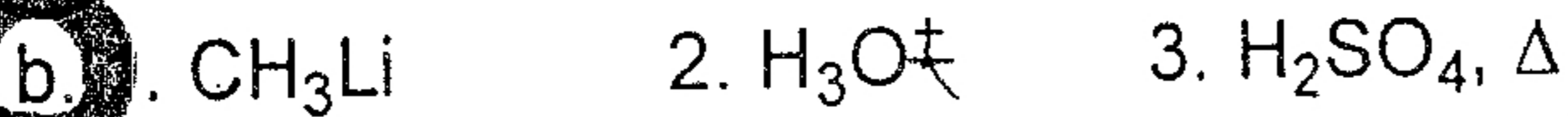
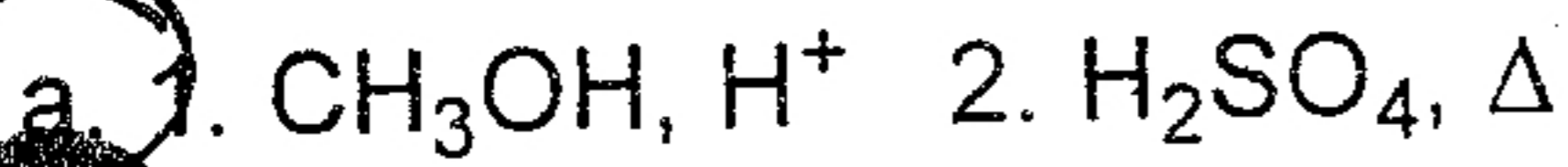
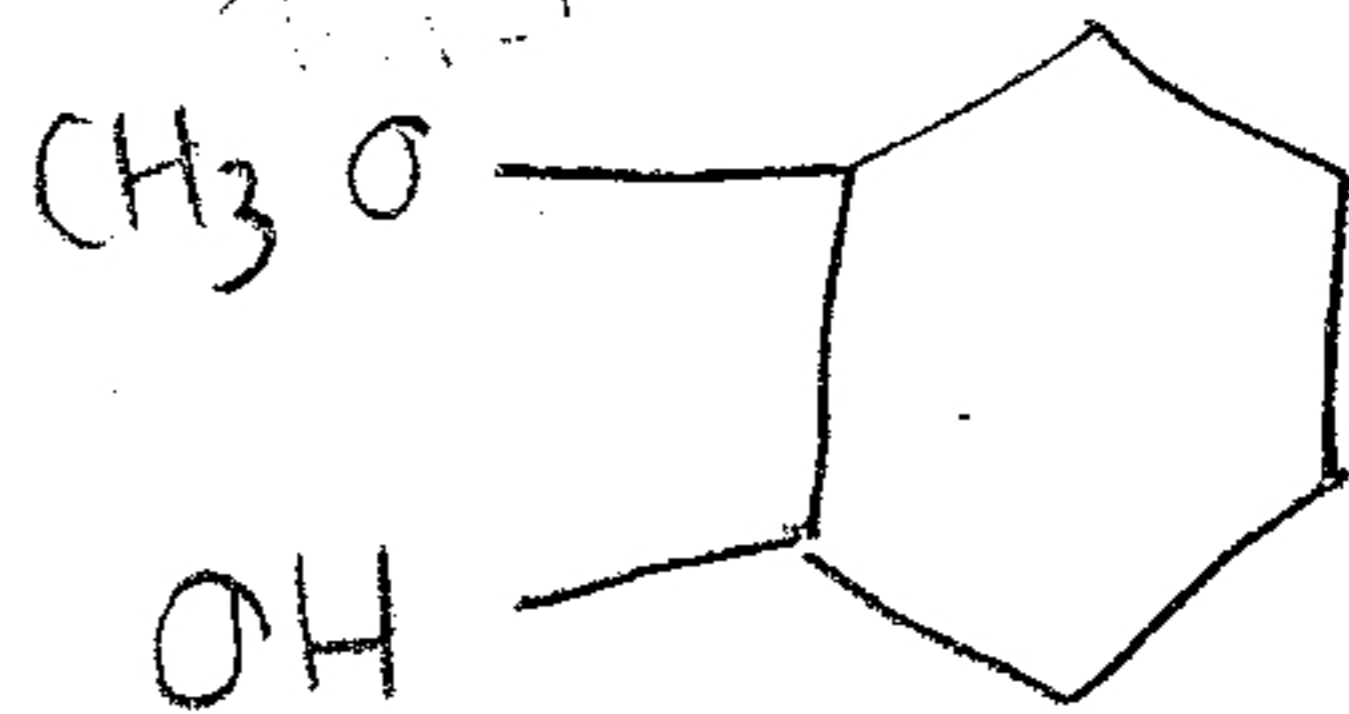
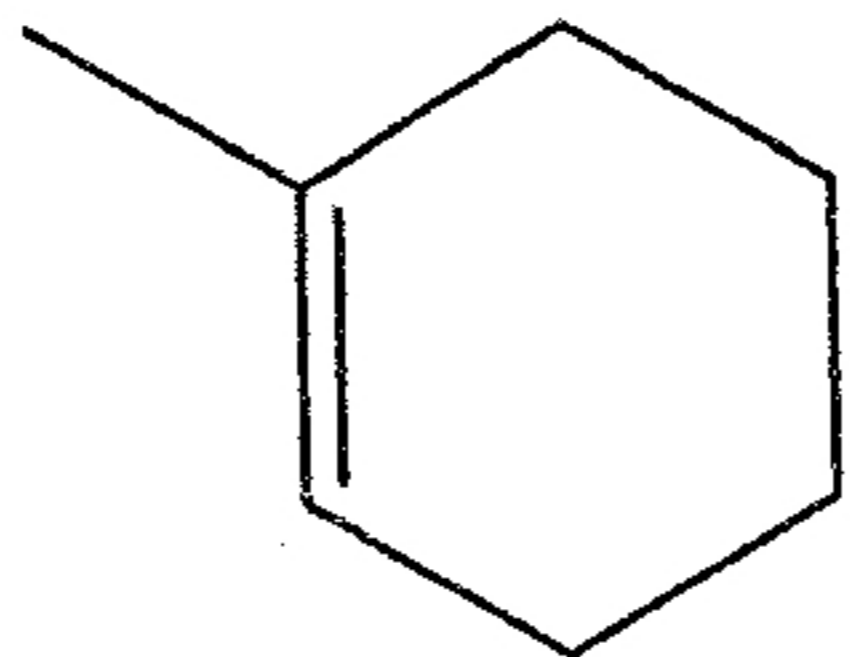
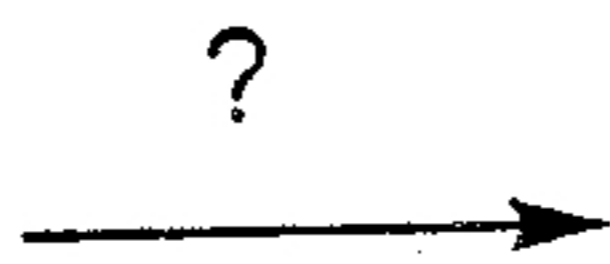
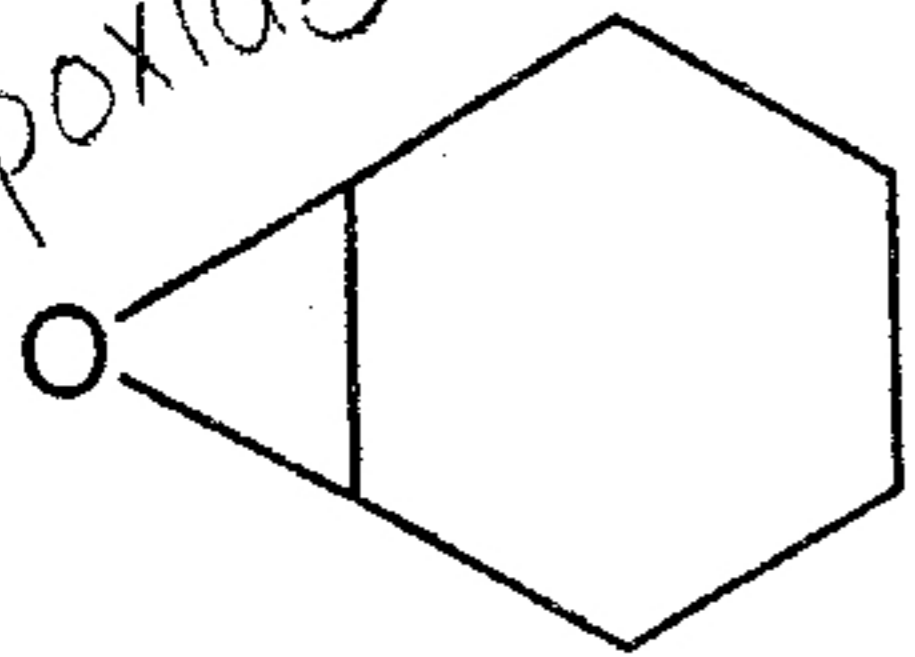
R Mg Br

1. Which of the following alkyl halides could be successfully used to form a Grignard reagent?

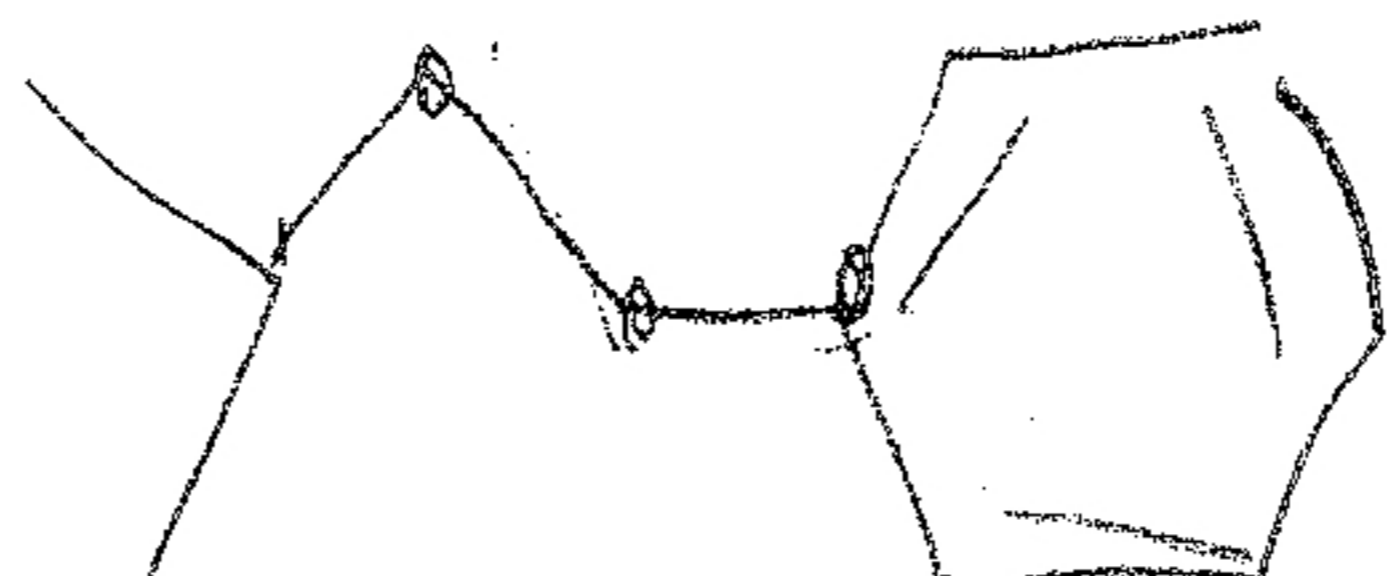
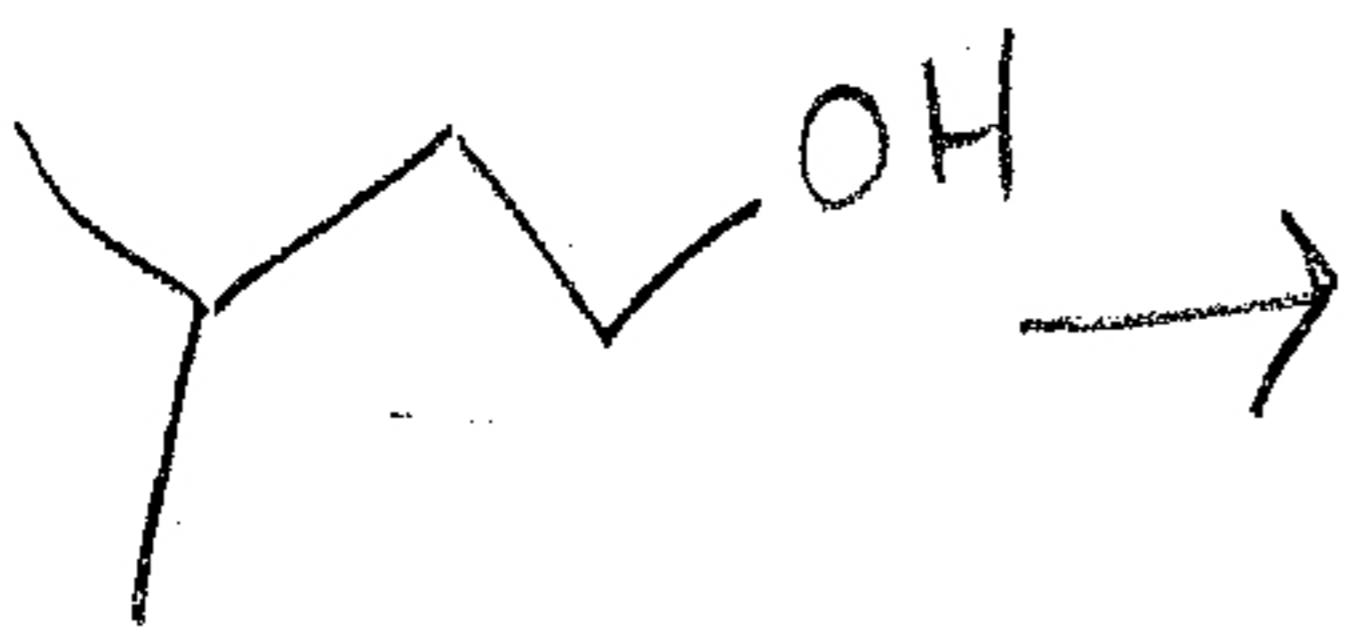
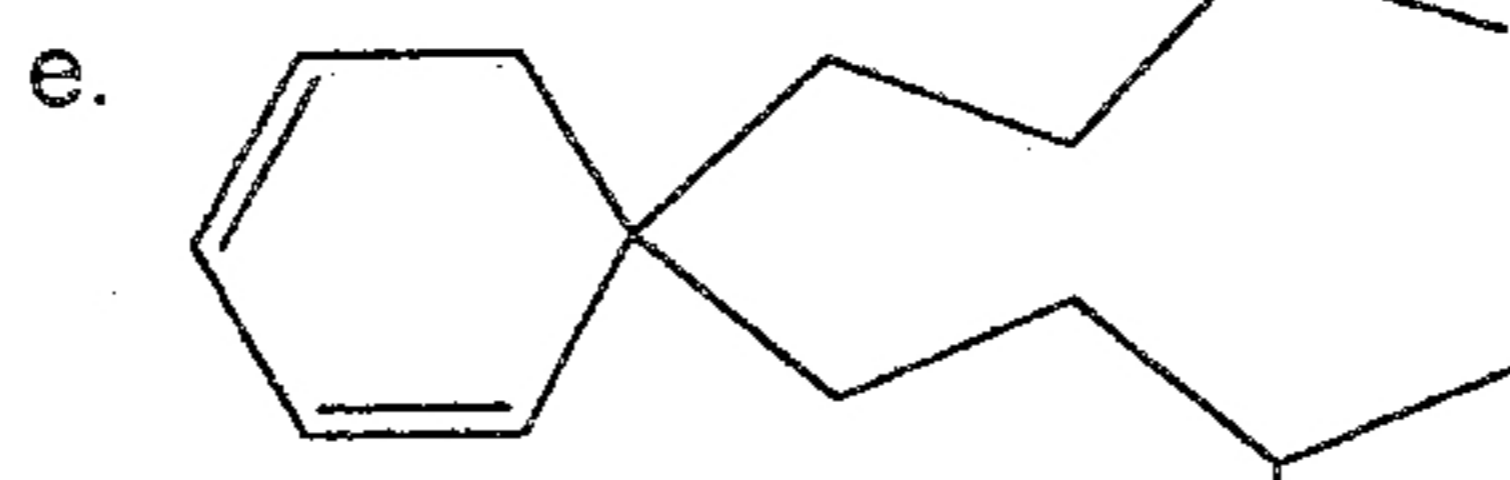
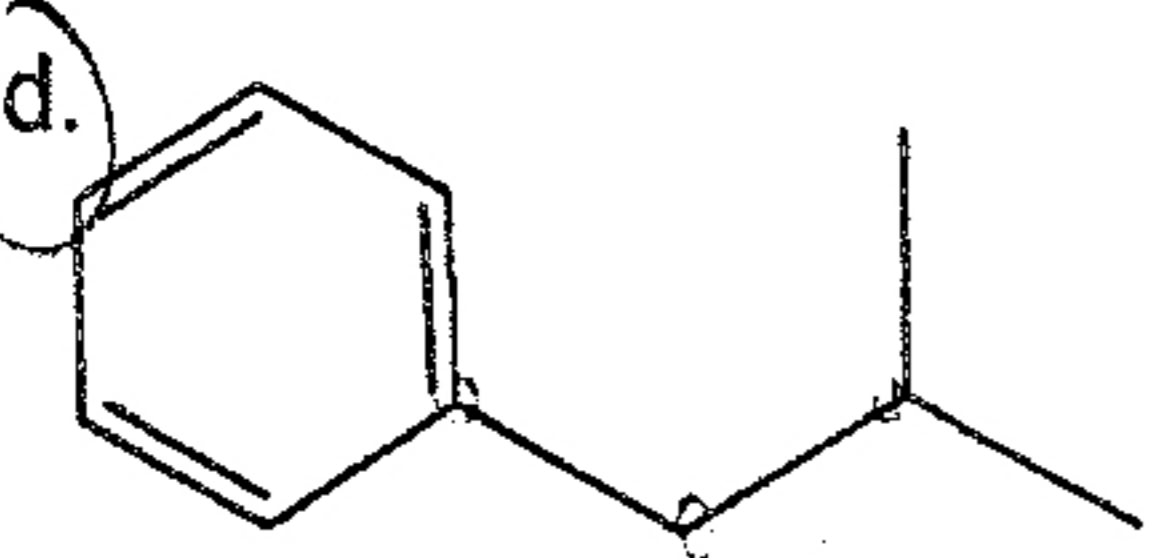
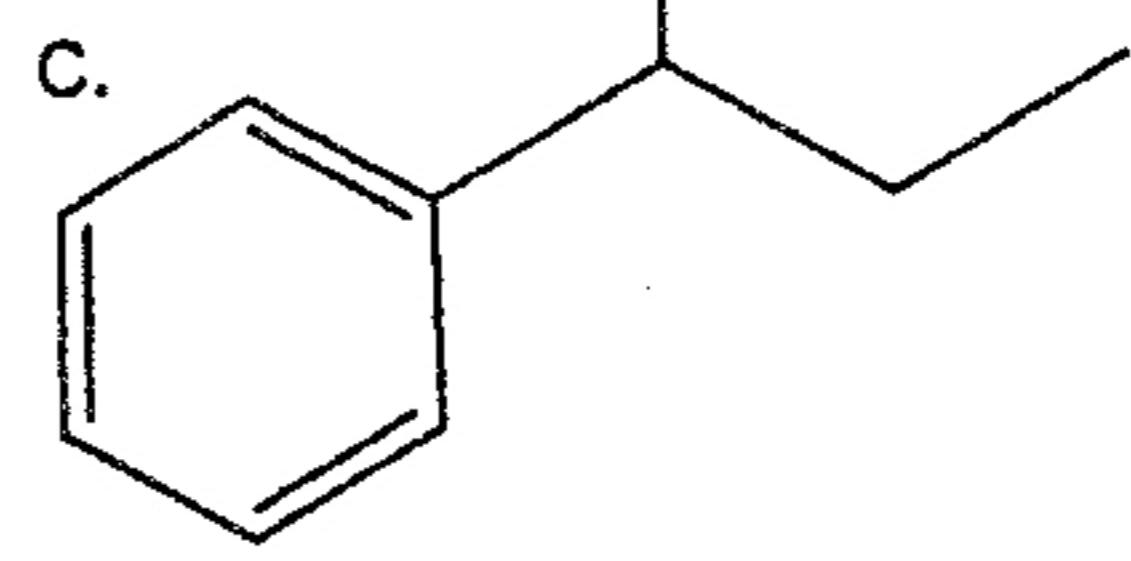
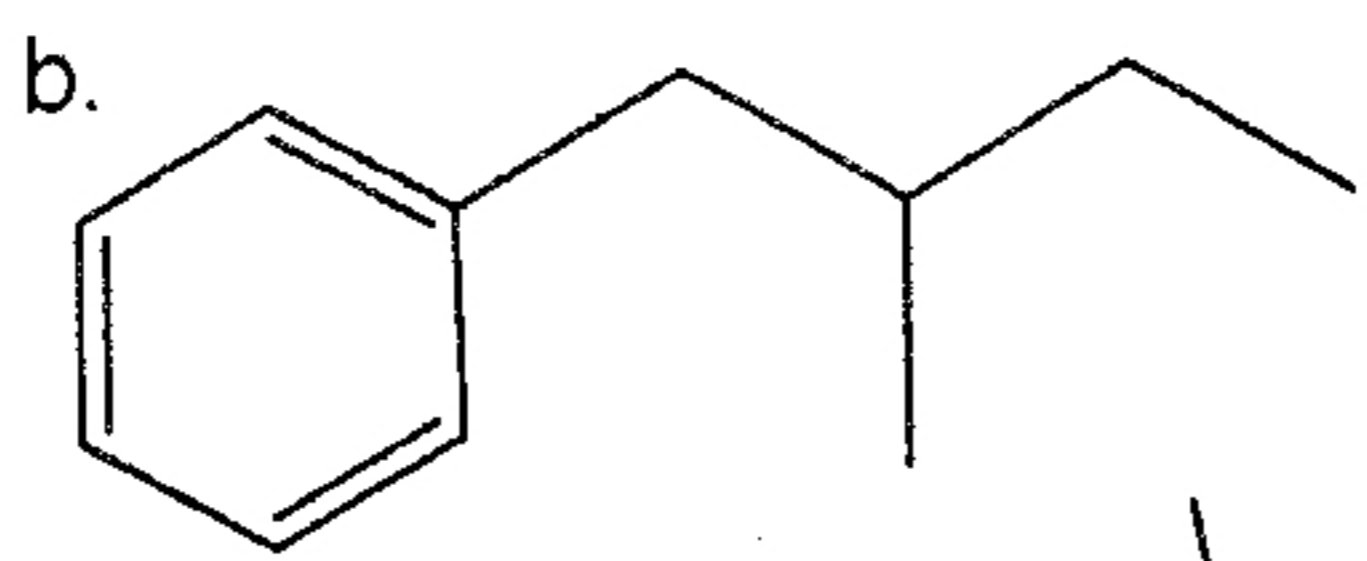
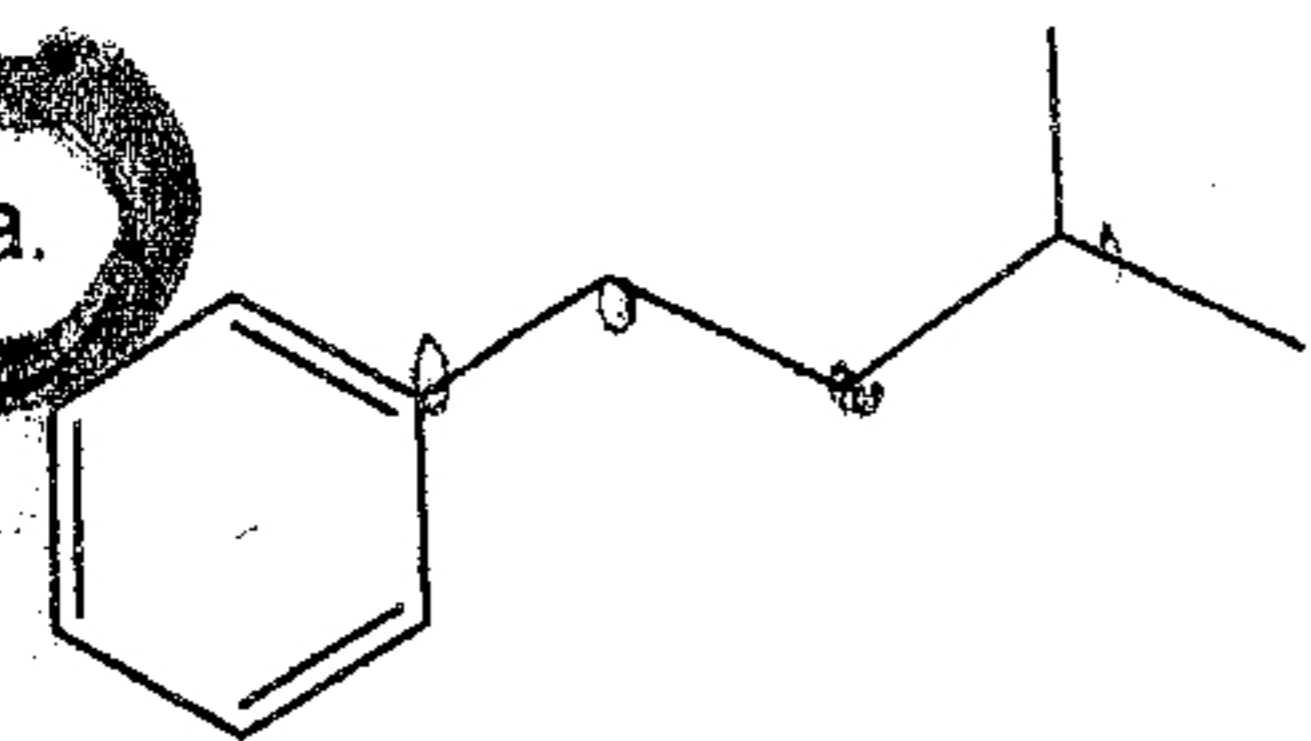
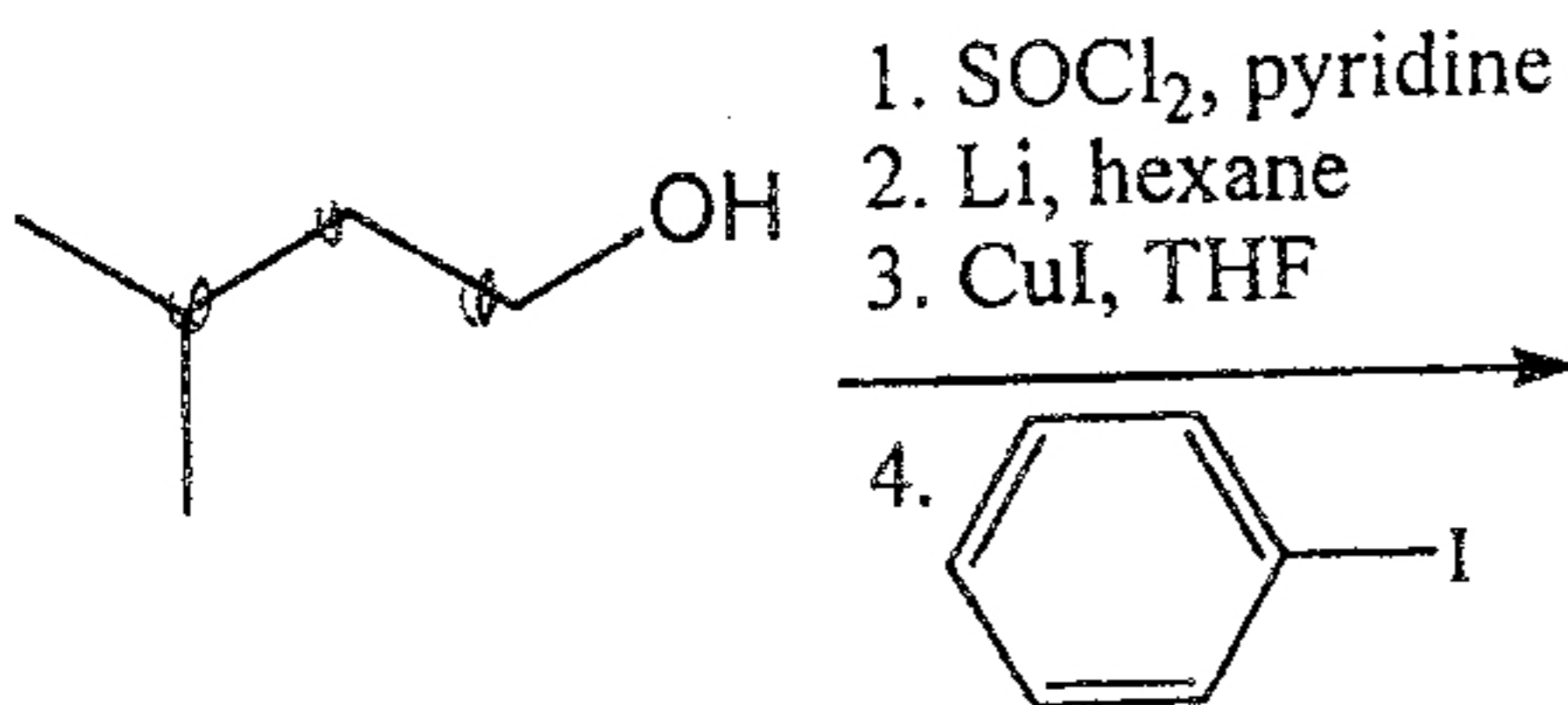


2. How could the following synthesis be carried out?

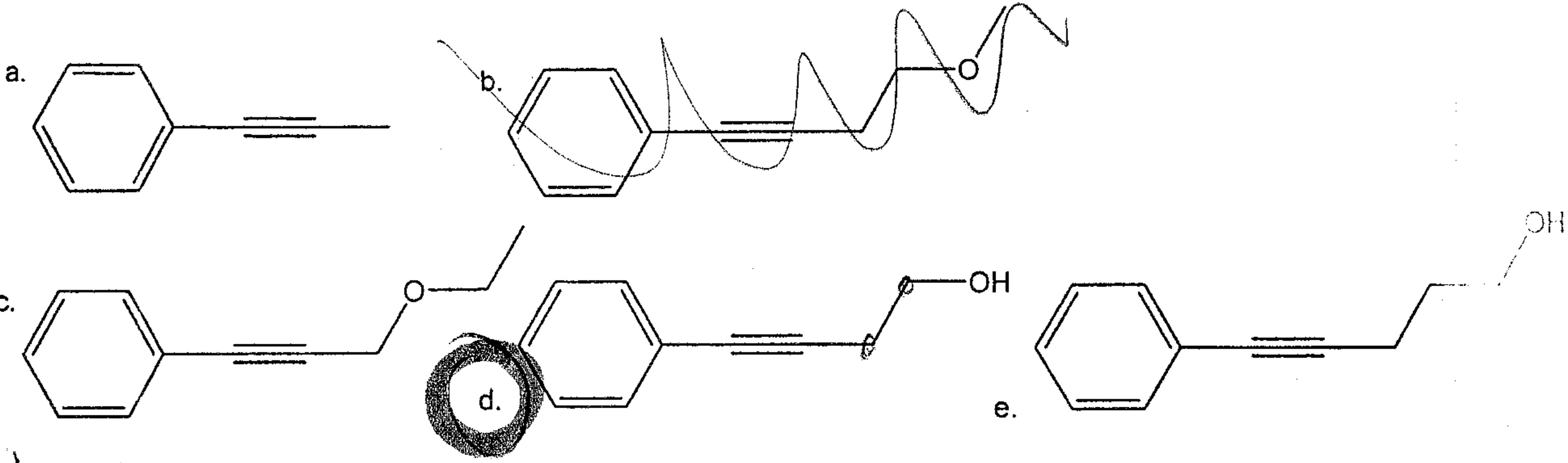
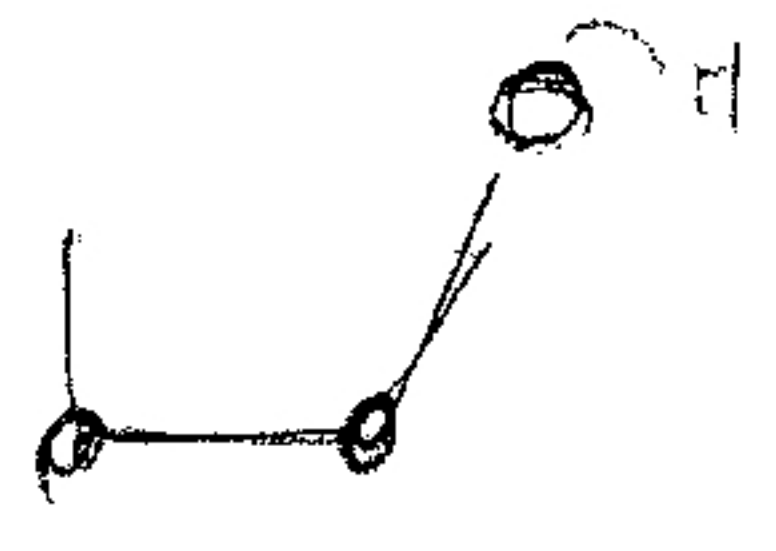
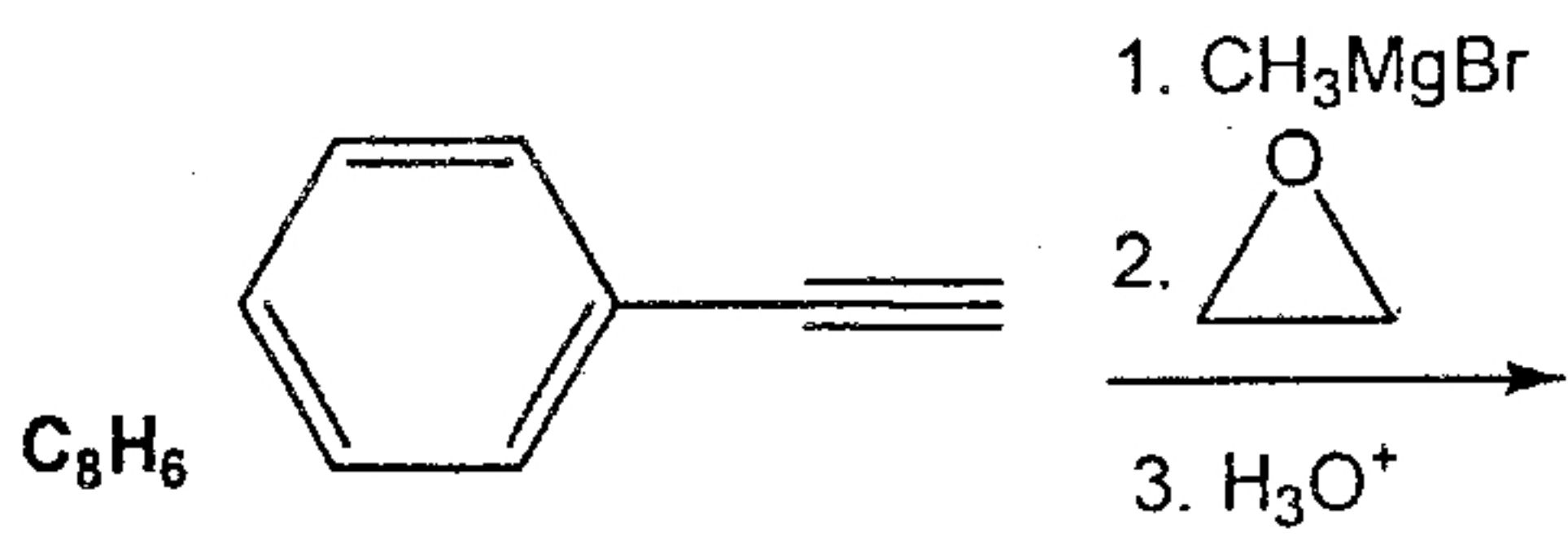
epoxide



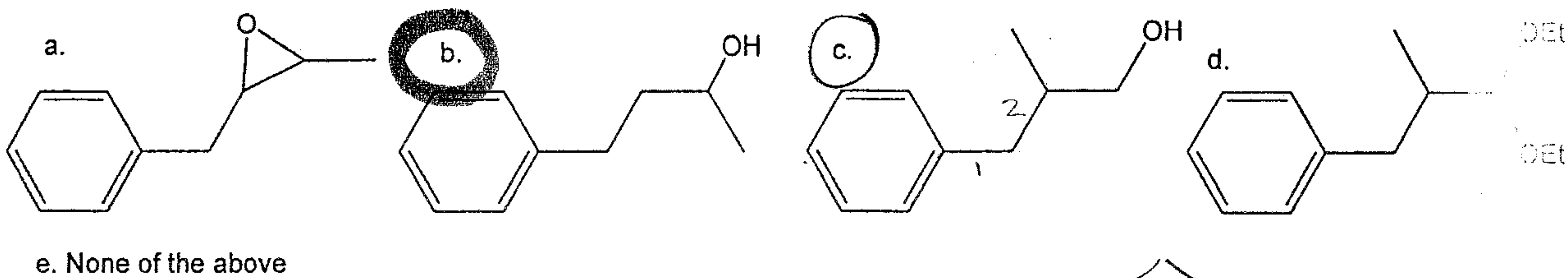
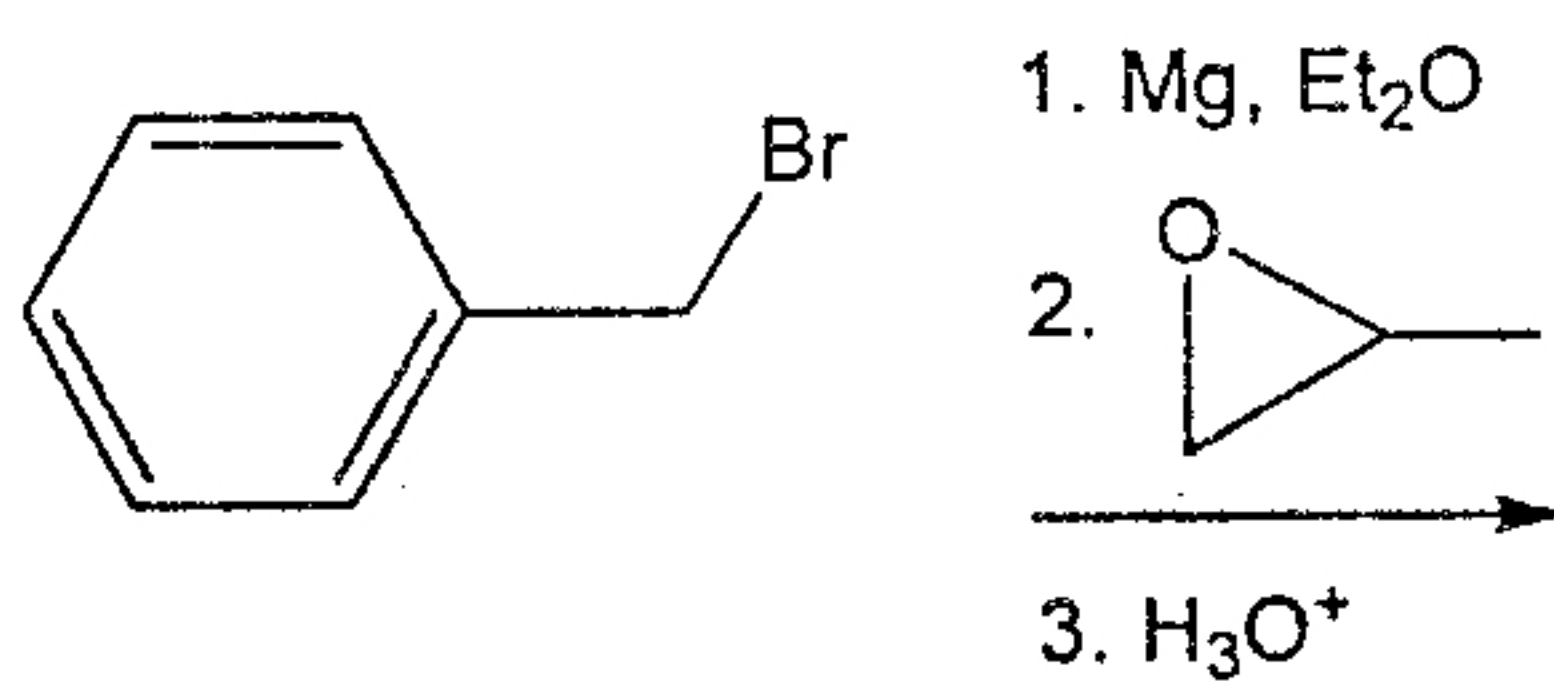
3. Indicate the organic product of the following sequence of reactions.



D 4. Indicate the product formed when the molecule shown, C_8H_6 , undergoes the following sequence of reactions.

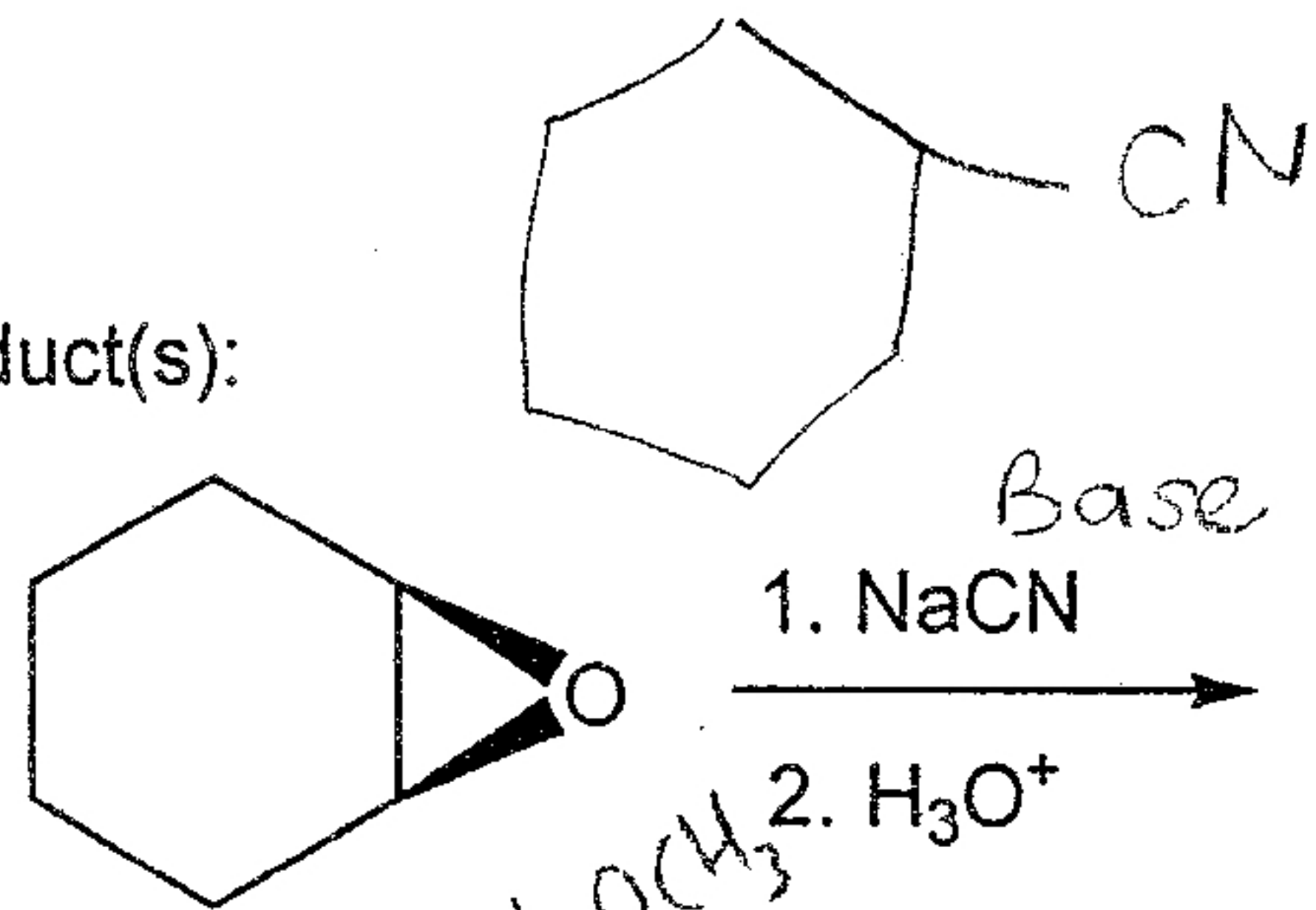


5. Indicate the major product formed.

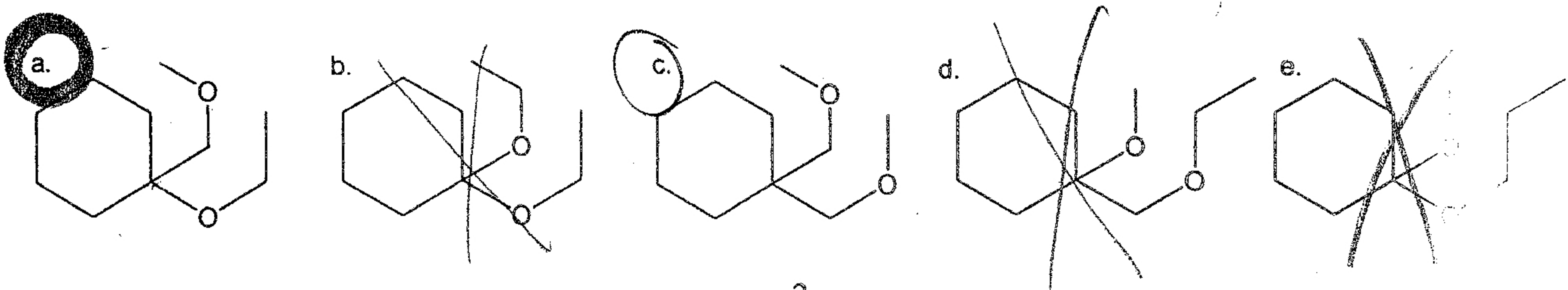
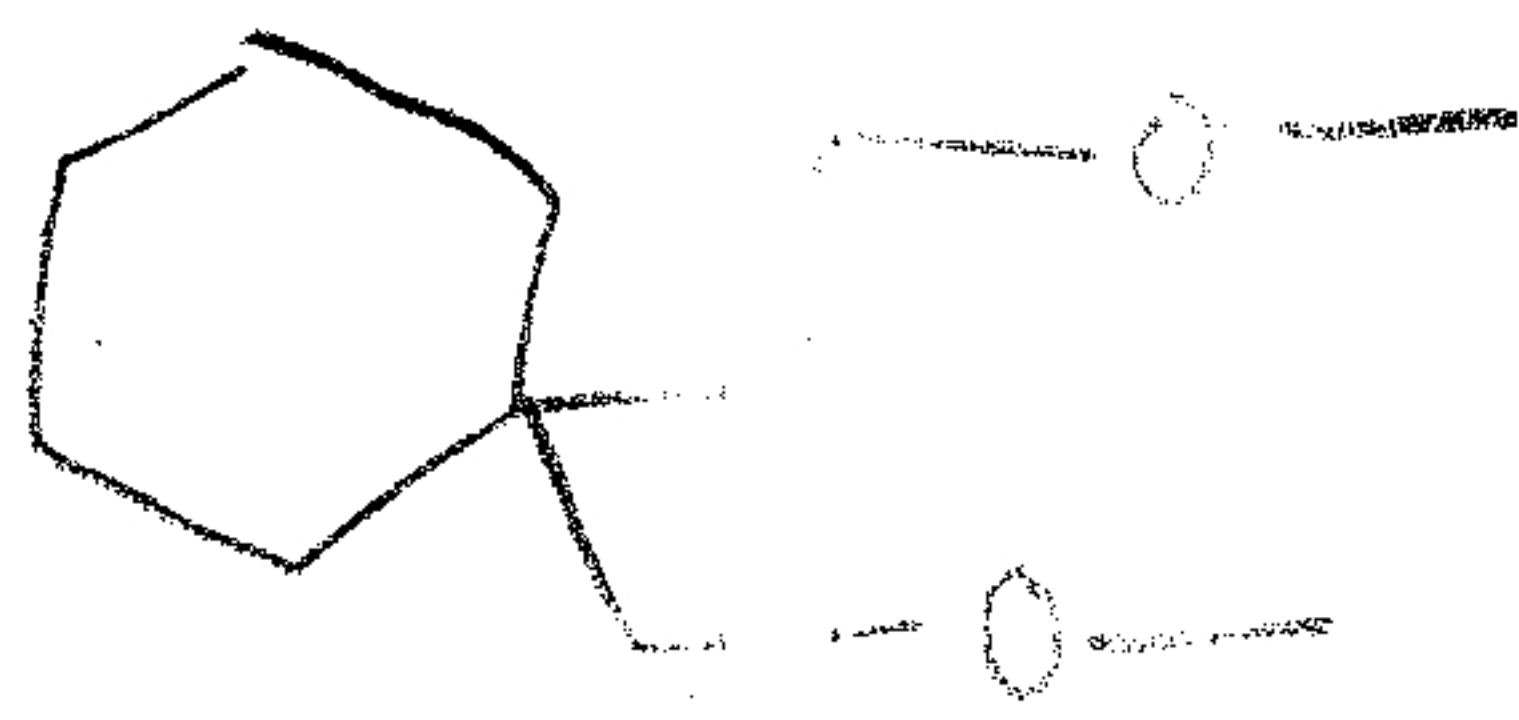
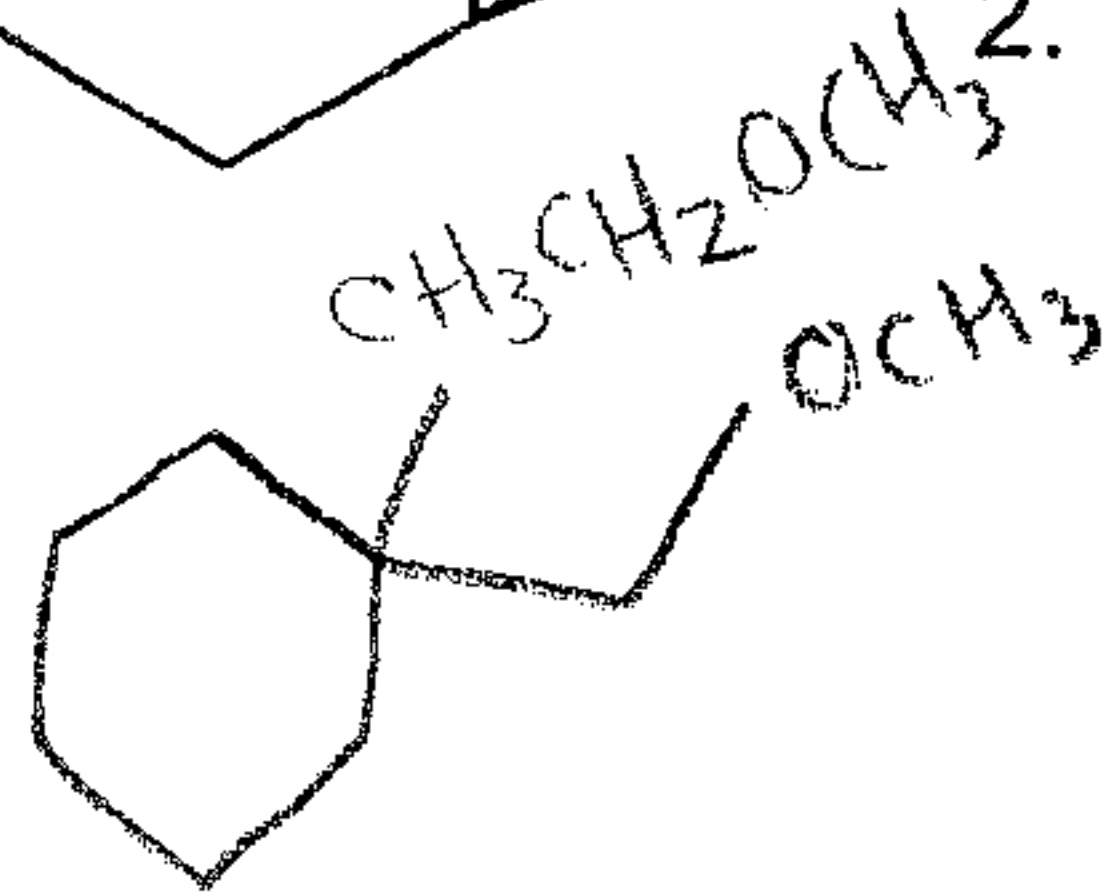
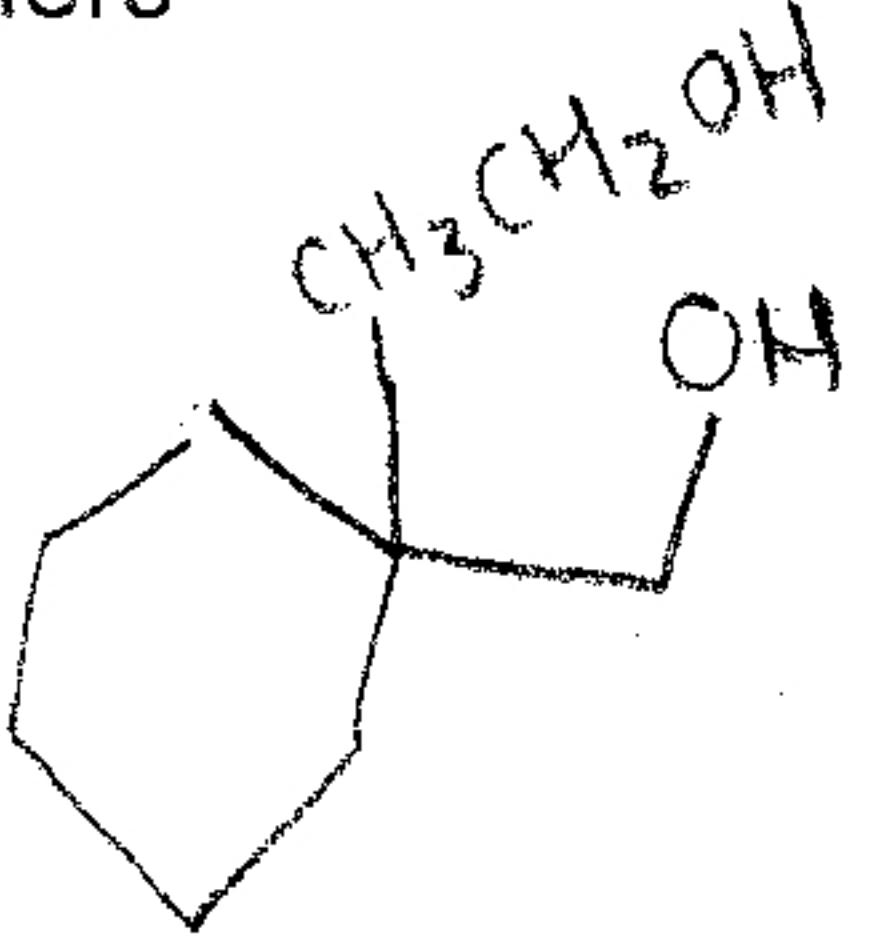
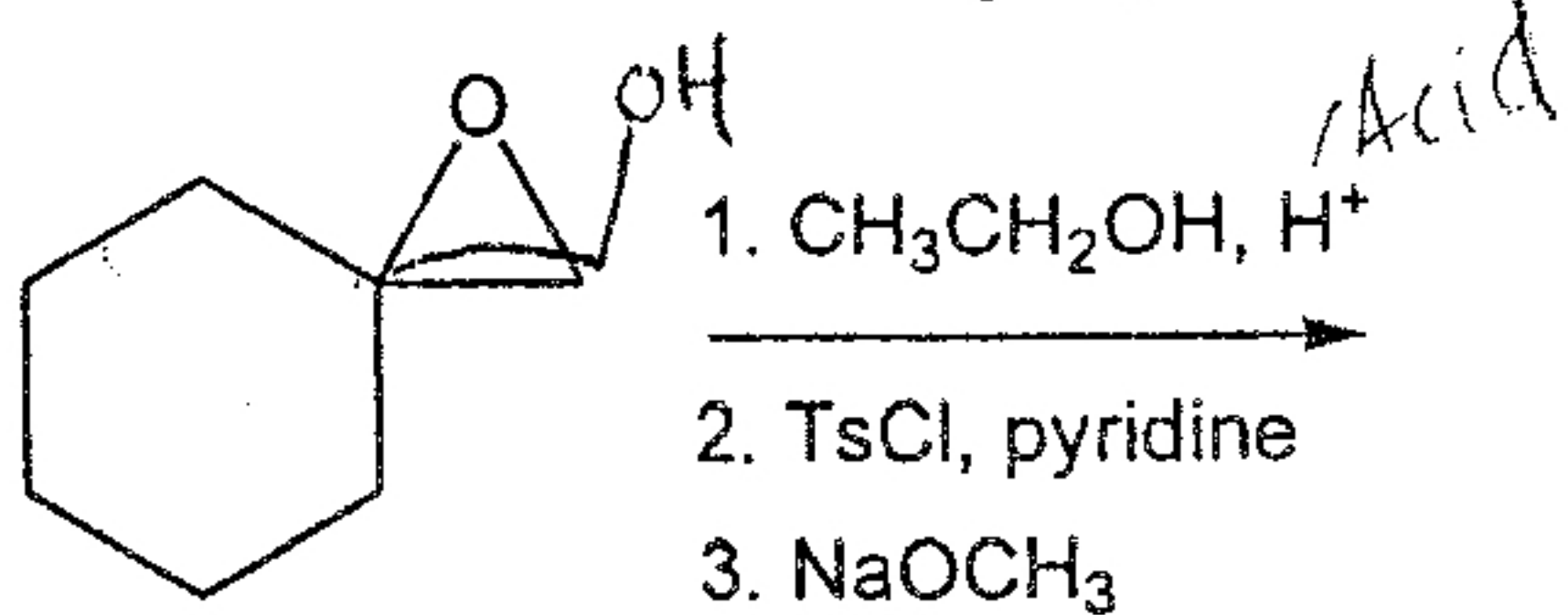


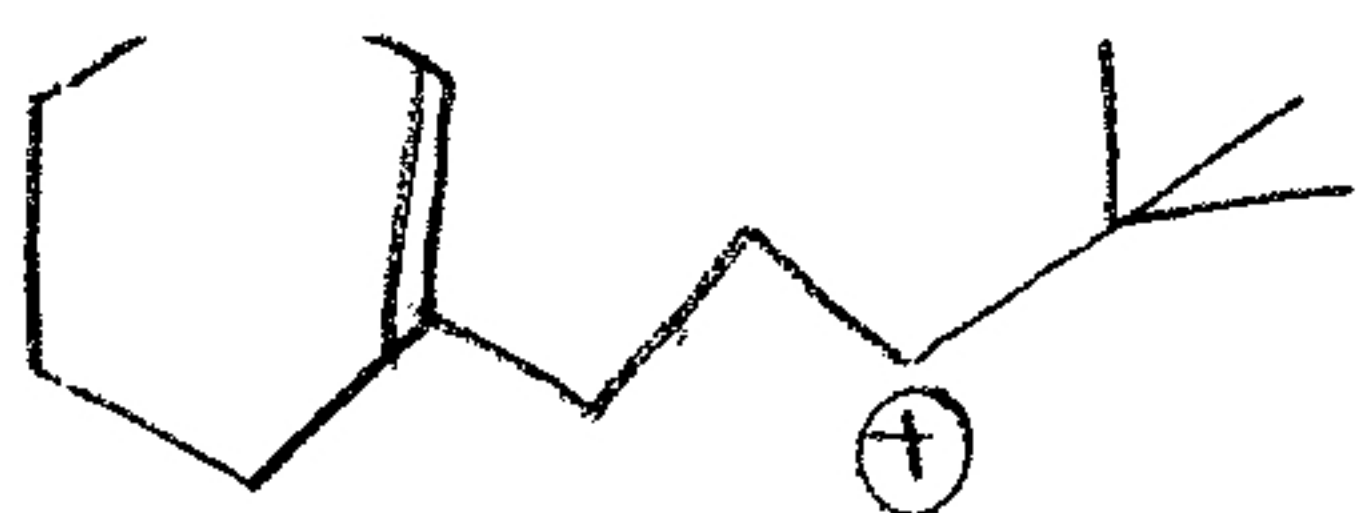
B 6. The following reaction produces what organic product(s):

- a. a single enantiomer
- b. a racemic mixture**
- c. an optically active mixture of enantiomers
- d. a mixture of diastereomers

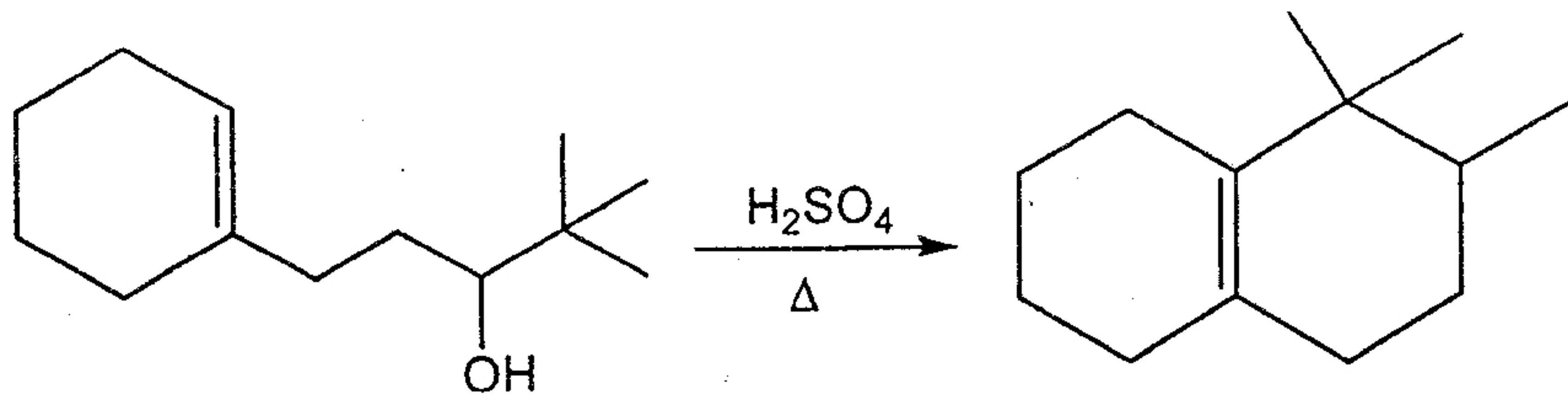


7. Indicate the major product.





B 8. Which mechanism best accounts for the following transformation?



- a.
 1. protonation of hydroxyl group
 2. loss of water to form carbocation
 3. intramolecular electrophilic attack of alkene onto carbocation
 4. 1,2-methyl shift
 5. deprotonation to form double bond
- b.**
 1. protonation of hydroxyl group
 2. loss of water to form carbocation
 3. 1,2-methyl shift
 4. intramolecular electrophilic attack of alkene onto carbocation
 5. deprotonation to form double bond
- c.
 1. protonation of hydroxyl group
 2. loss of water to form carbocation
 3. 1,2-hydride shift
 4. intramolecular electrophilic attack of alkene onto carbocation
 5. deprotonation to form double bond
- d.
 1. protonation of hydroxyl group
 2. dehydration to form double bond
 3. intramolecular Diels-Alder reaction
- e. None of the above.

D 9. Which of the following would be the preferred solvent to use in IR spectroscopy (hint: which will least interfere with analyte signal)?

a. H₂O

b. CCl₄

~~c. CH₃OH~~

~~d. CH₃CH₂OH~~

~~e. benzene (C₆H₆)~~

D 10. Which of the following is/are true about the mass spectrum of 1-bromobutane?

- ~~a.~~ Peaks of approximately equal intensity are observed at m/z 136 and 138.
~~b.~~ The major fragmentation occurs by cleavage of the C-Br bond.
~~c.~~ The most intense peak occurs at m/z 43
d. both A and B
~~e.~~ both A and C

B 11. Indicate the organic products expected when 2-pentanol is heated in the presence of sulfuric acid. Of those formed, which is the major product?



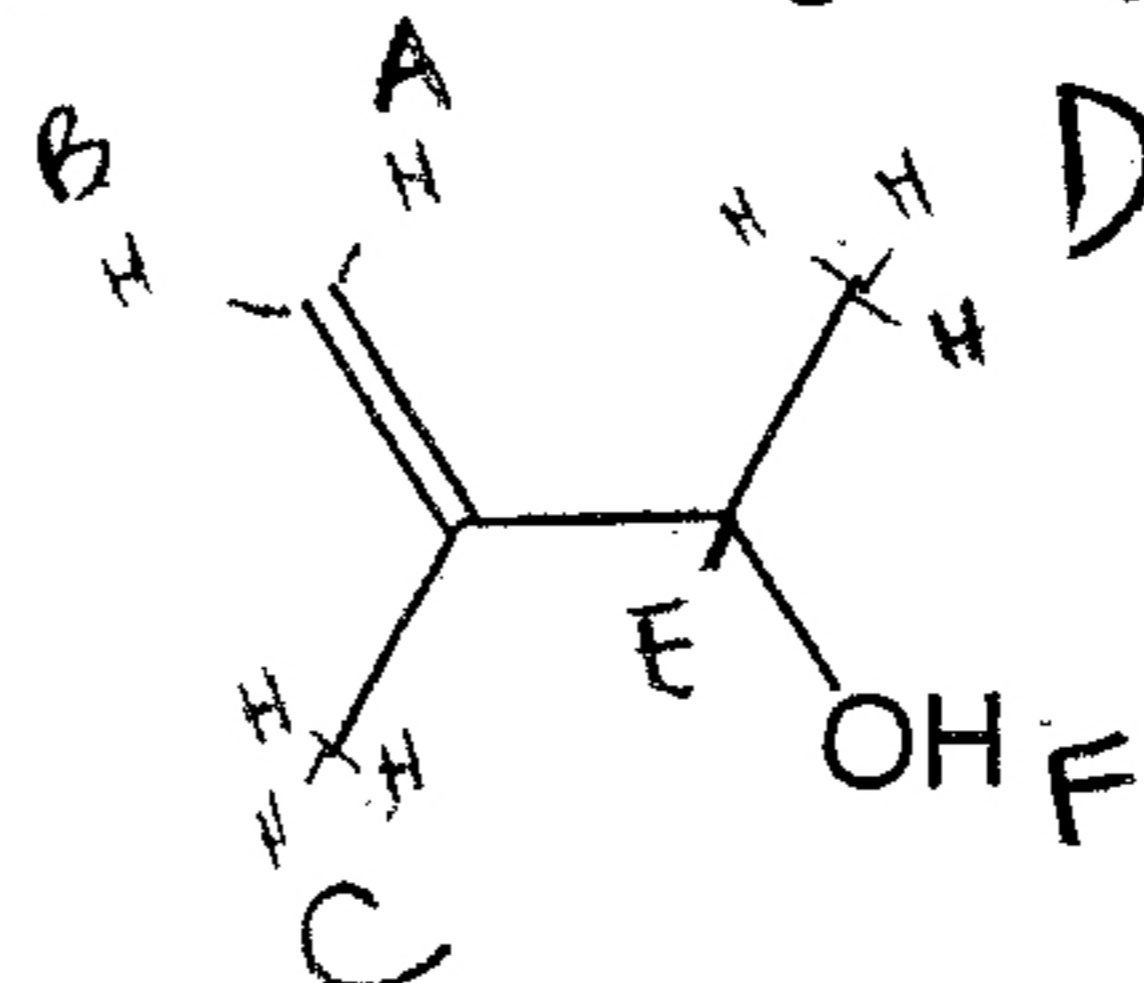
- ~~a.~~ 1, 2 expected, with 1 major
b. 1, 2, 3 expected, with 2 major
~~c.~~ 1, 2, 3 expected, with 3 major
~~d.~~ 1, 2, 3, 4 expected, with 2 major
~~e.~~ 1, 2, 3, 4, 5 expected, with 3 major



For each of the following compounds indicate the number of NMR signals you would expect to see (ignoring splitting).

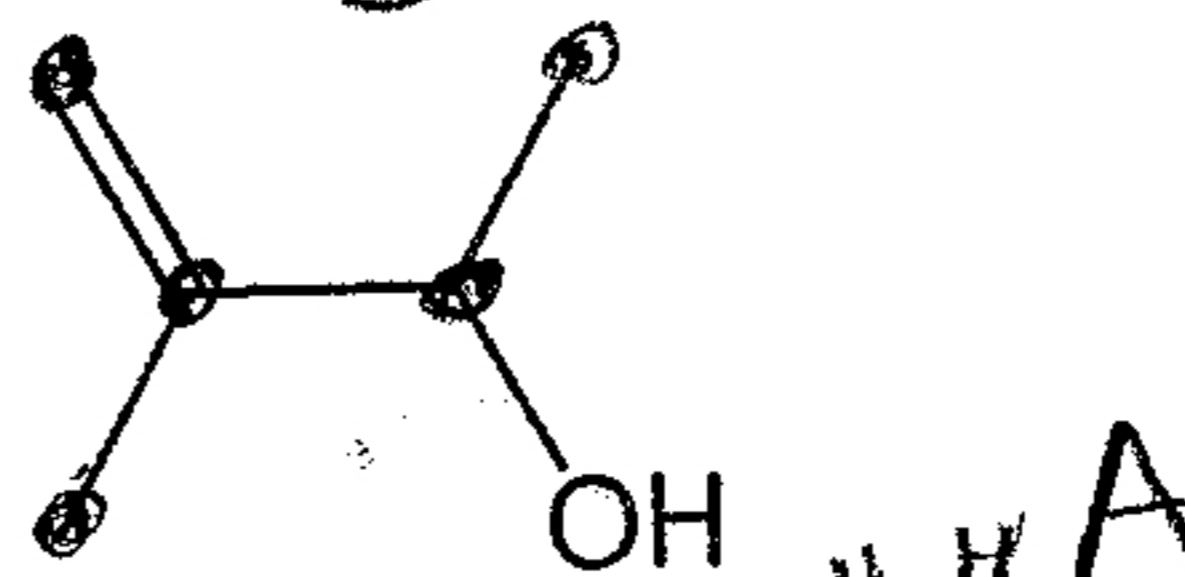
E 12. # of ^1H NMR signals

- a.2 b.3 c.4 d.5 **e.6**



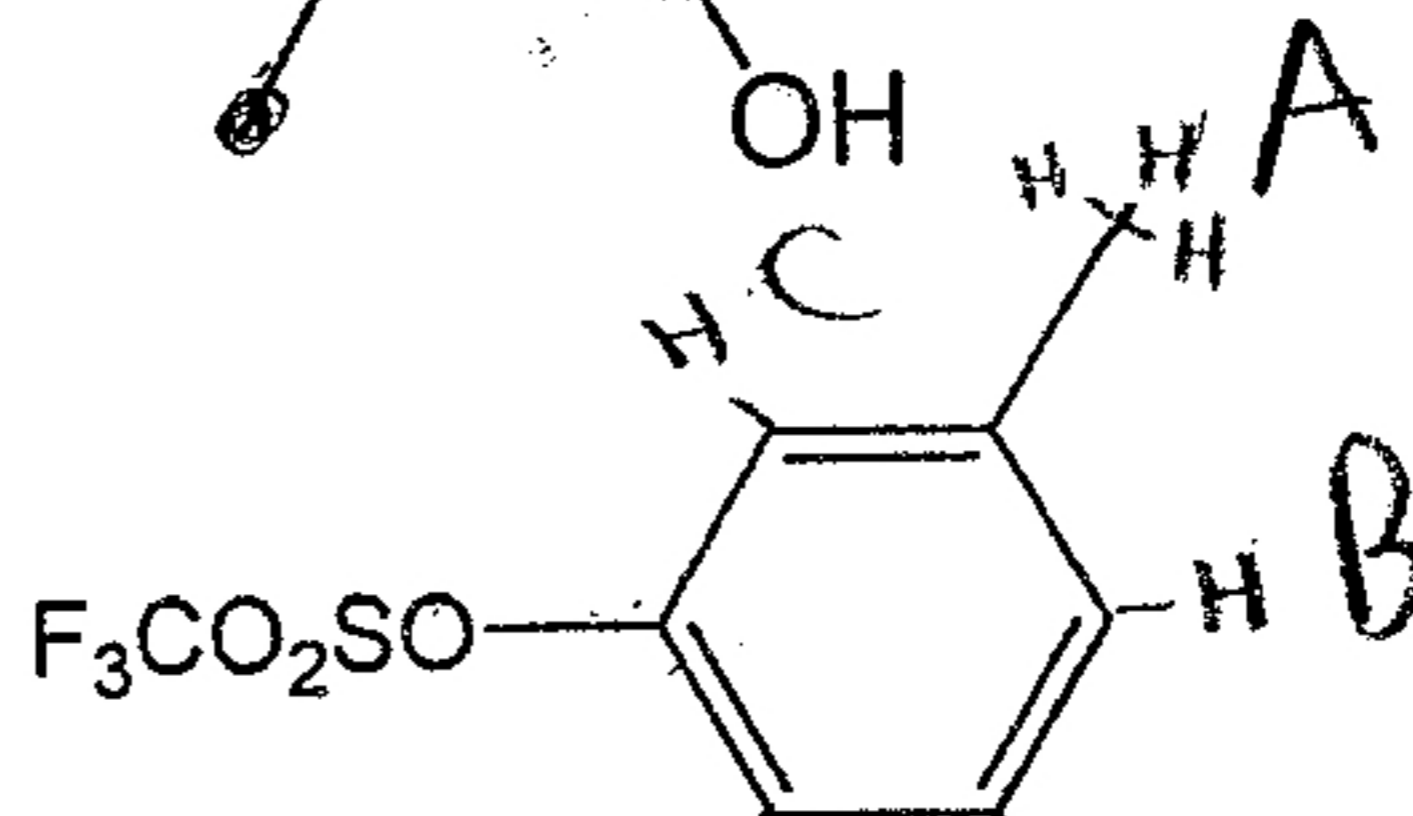
D 13. # of ^{13}C NMR signals

- a.2 b.3 c.4 **d.5** e.6



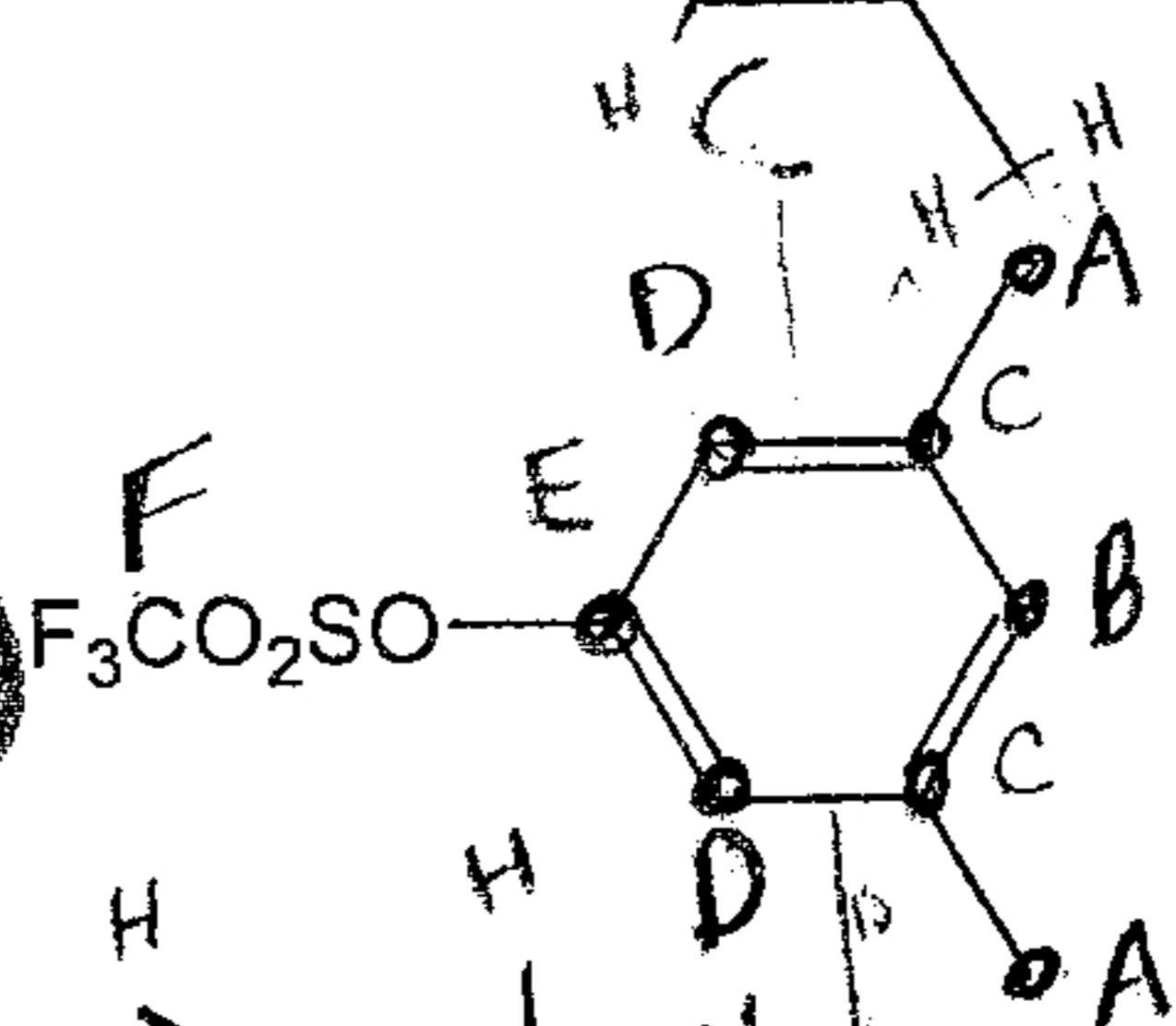
B 14. # of ^1H NMR signals

- a.2 **b.3** c.4 d.5 e.6



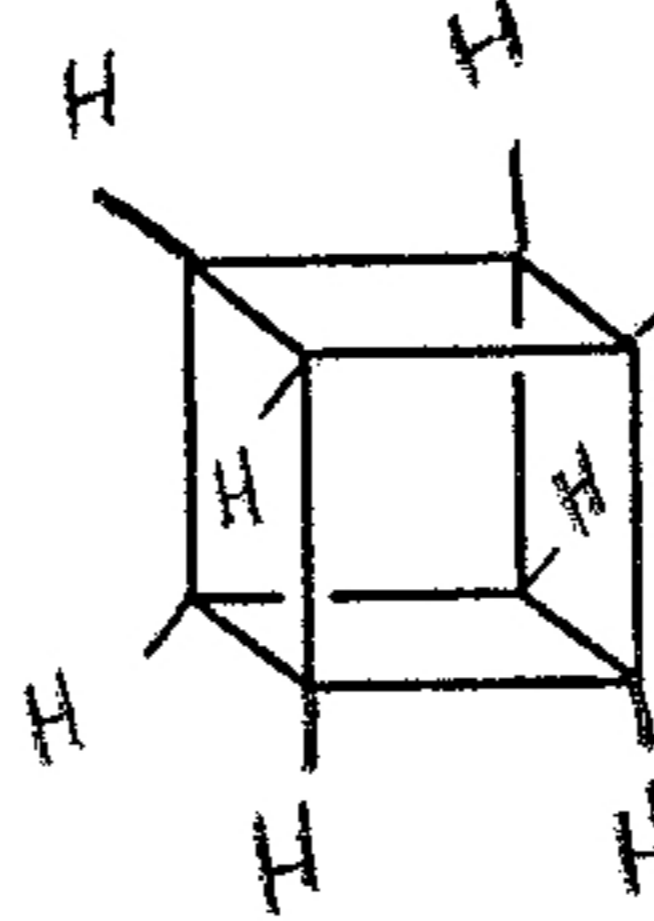
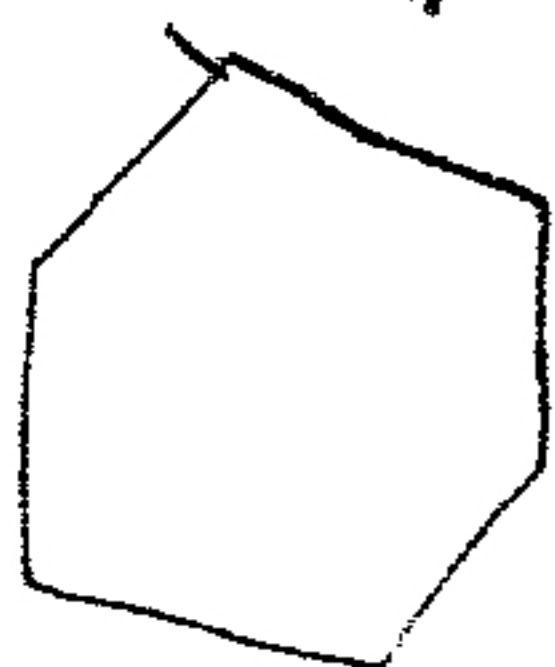
E 15. # of ^{13}C NMR signals

- a.2 b.3 c.4 **d.5** **e.6**



A 16. # of ^1H NMR signals

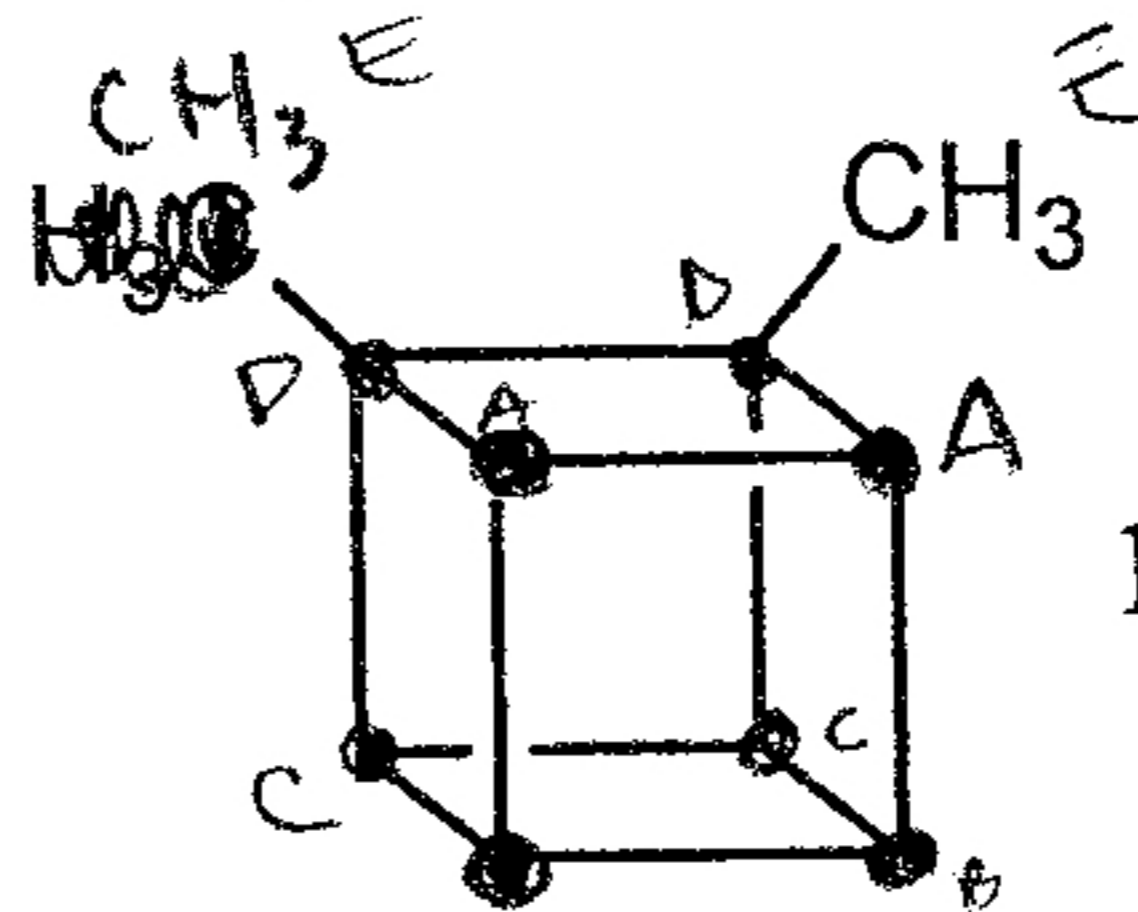
- a.1** b.2 c.4 d.6 e.8



"cubane" C_8H_8 , a cube-shaped hydrocarbon

17. # of ^{13}C NMR signals

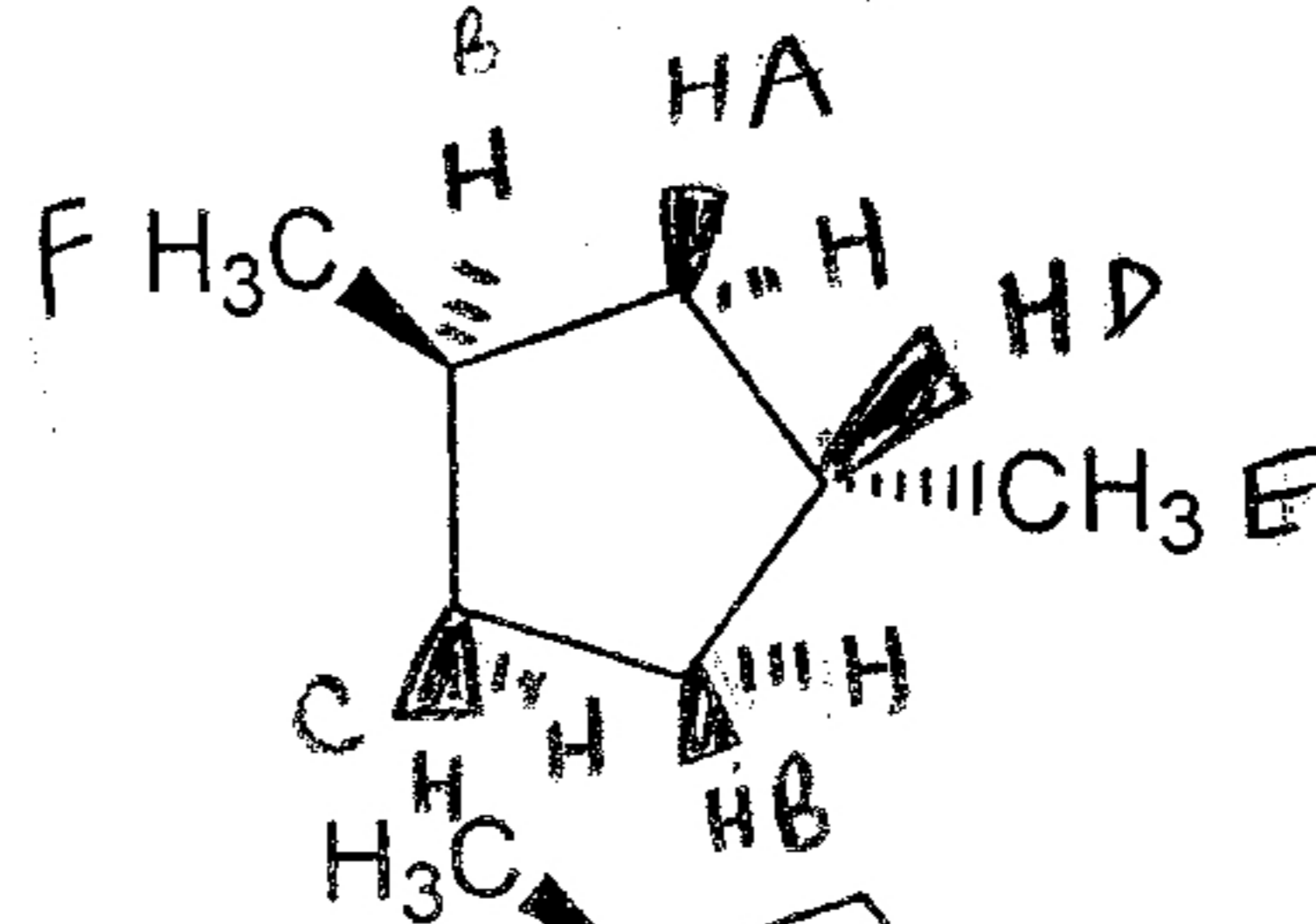
- a.3 **b.4** **c.5** d.6 e.7



1,2-dimethylcubane

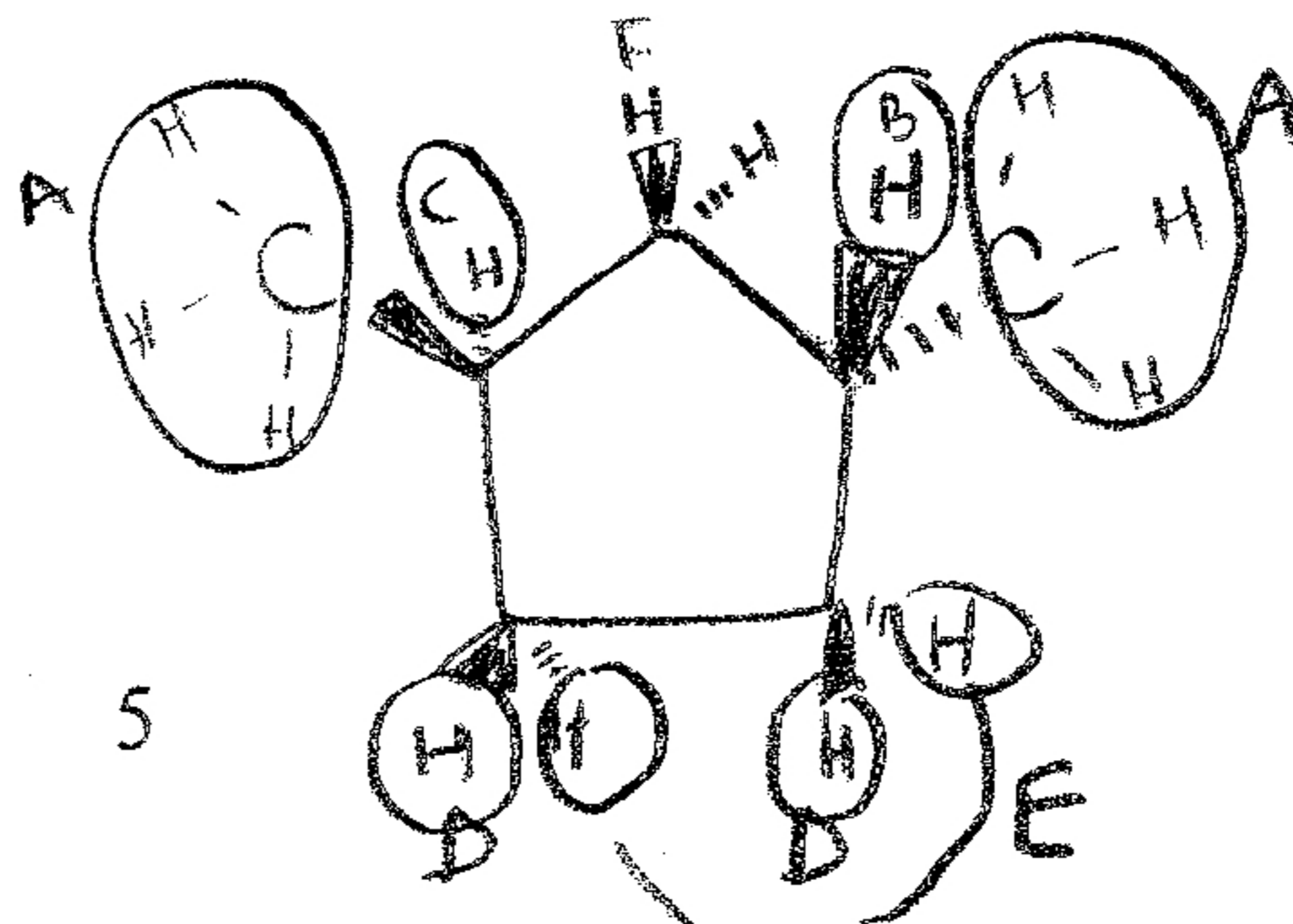
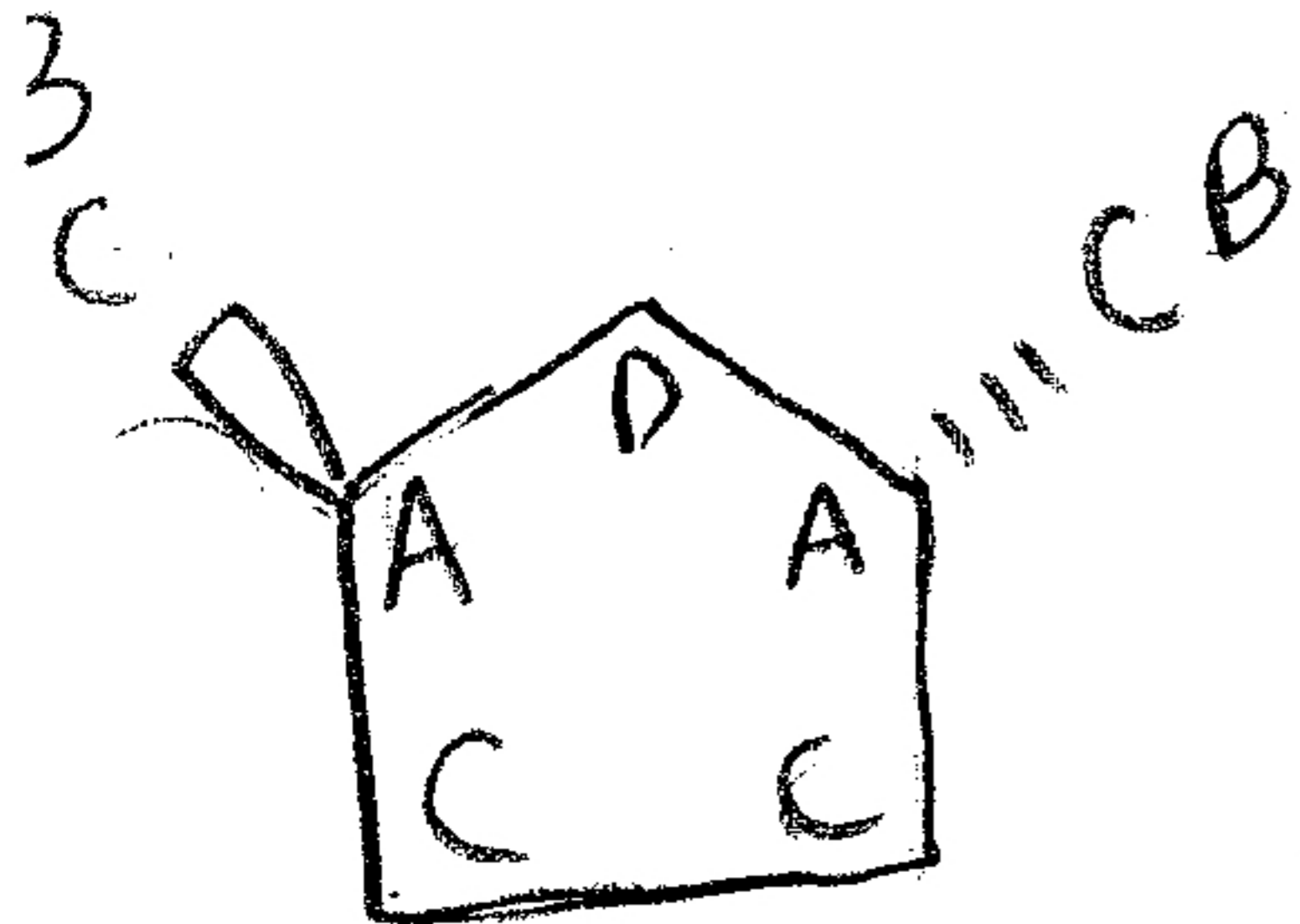
18. # of ^1H NMR signals

- ~~a.3~~ ~~b.4~~ ~~c.5~~ **d.6** e.7



D 20. # of ^{13}C NMR signals

- a.1 b.2 c.3 **d.4** e.5



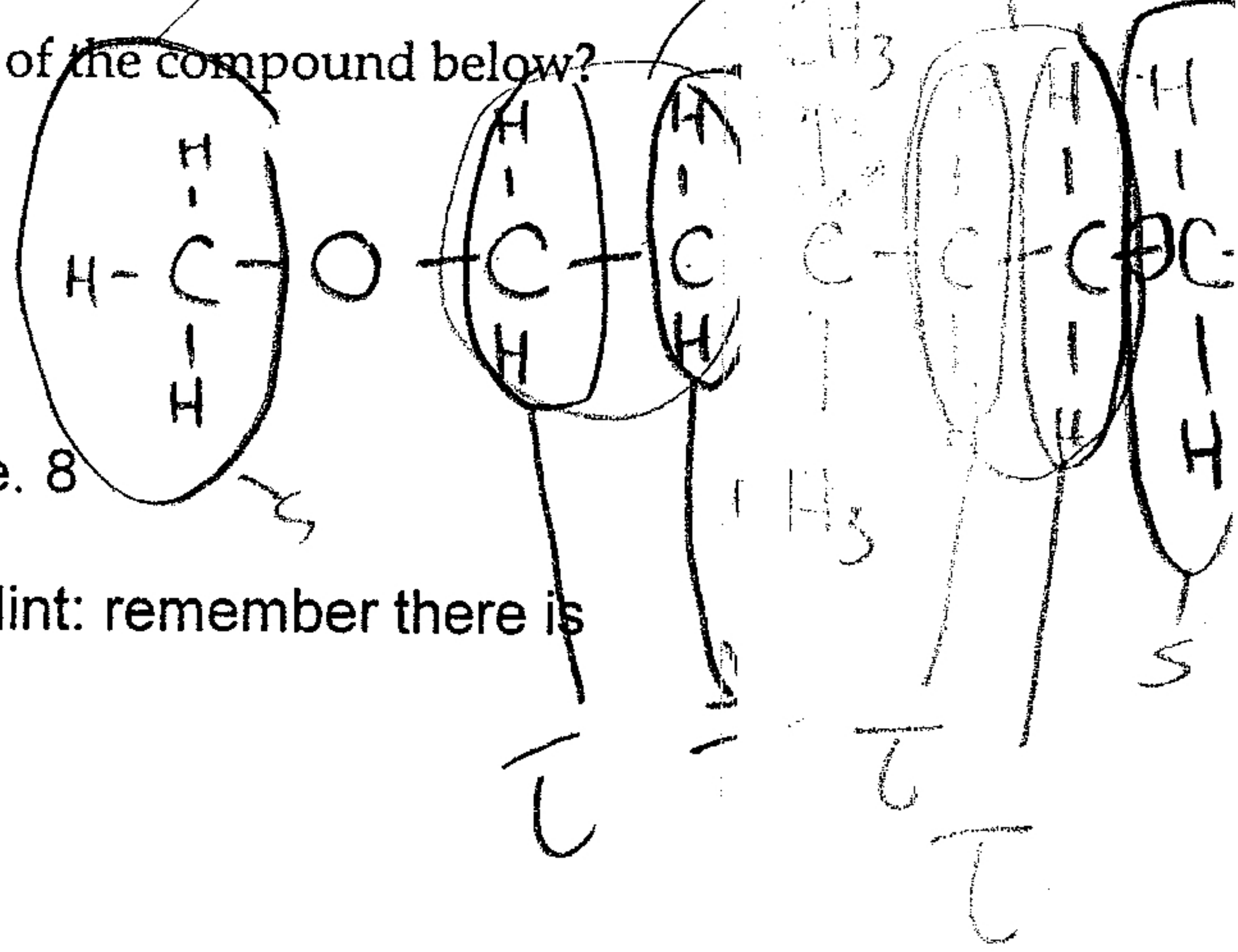
21. Which of the following spectroscopic techniques uses the lowest energy of the electromagnetic radiation spectrum?

- a. NMR ~~b. UV/Vis~~ c. IR d. X-ray crystallography

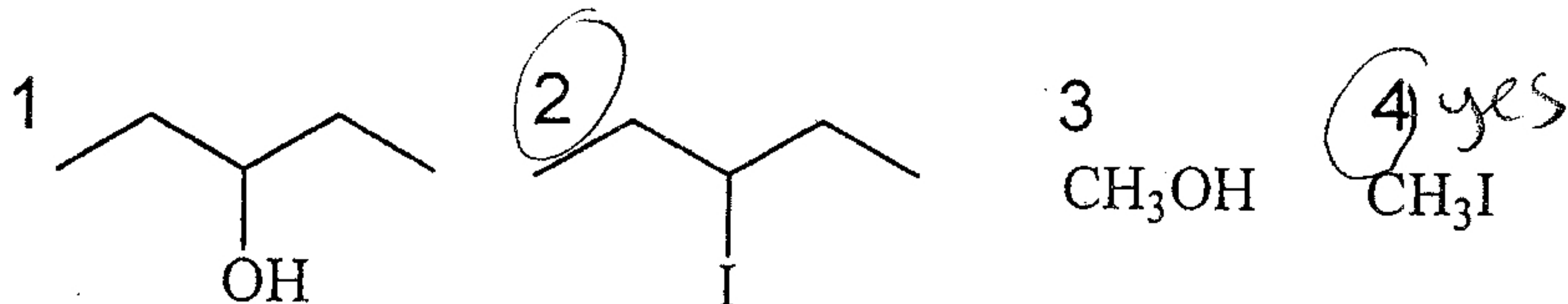
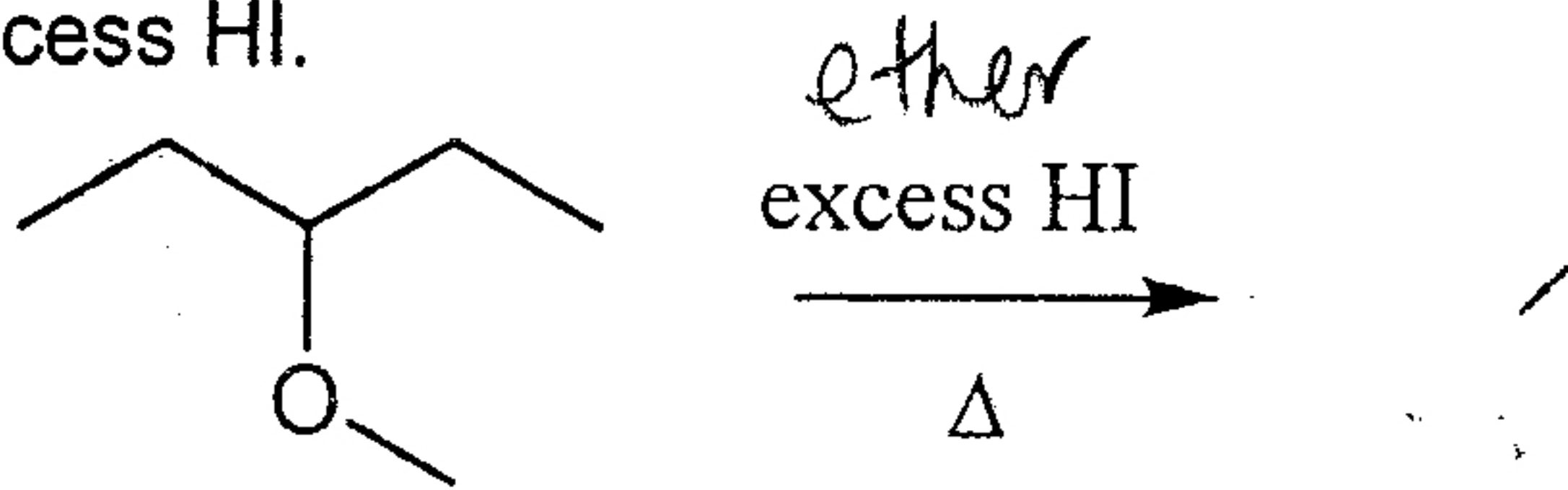
22. How many distinct triplets would you expect in the ^1H NMR of the compound below?



- a. 0 b. 1 c. 2 d. 4 e. 8

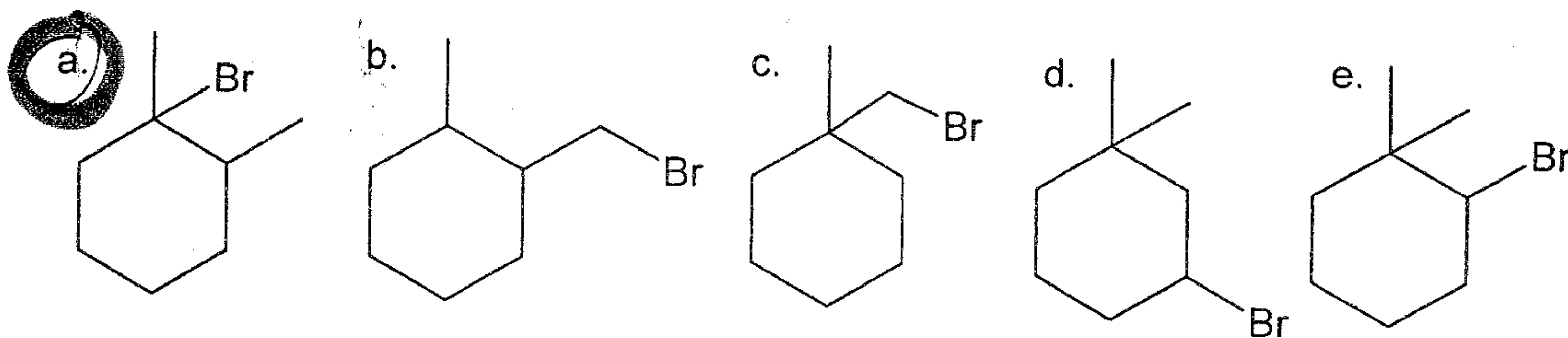
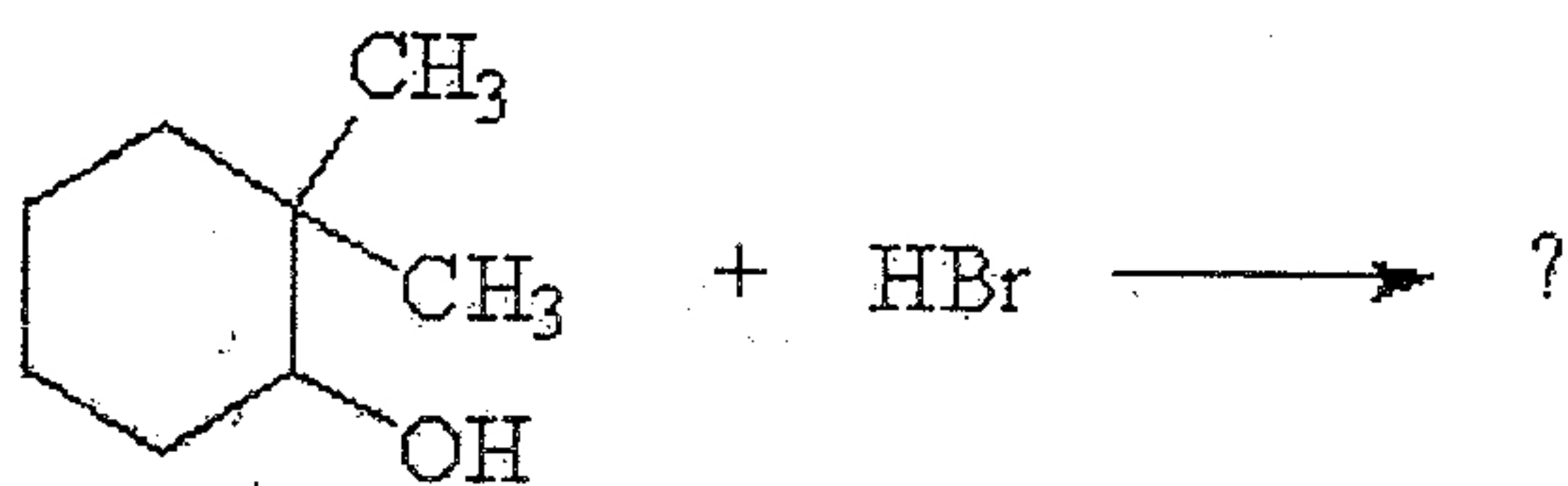


23. The following reaction produces which final products? Hint: remember there is excess HI.



- a. 1, 4 b. 2, 3 c. 1, 3 d. 2, 4

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



25. Which of the following is not true about the $M+1$ peak in mass spectrometry?

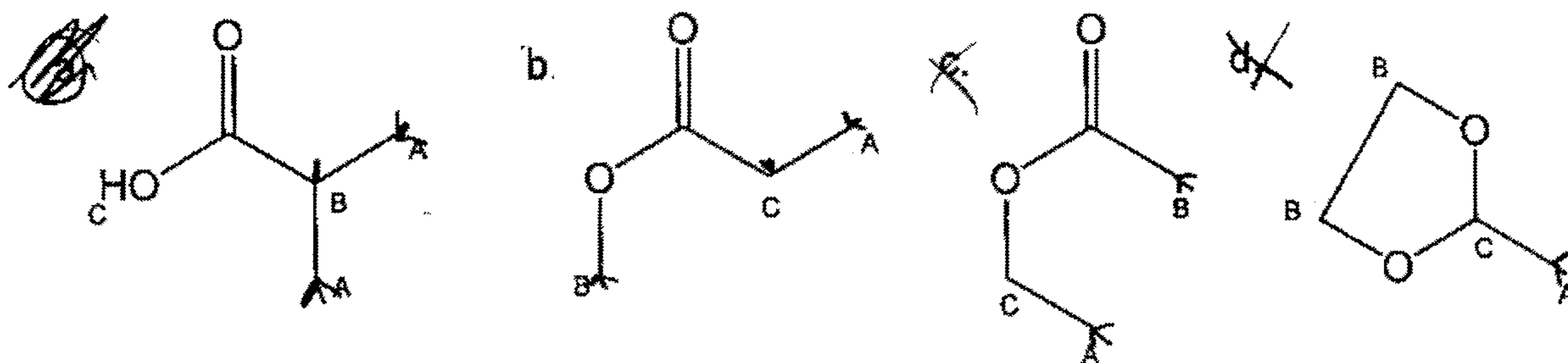
- a. It is one m/z unit higher than the base peak. b. It occurs because there is more than one naturally occurring isotope of carbon c. It is one m/z unit higher than the molecular ion peak *TBM* d. This means that the number of carbon atoms in a compound can be calculated if the relative abundance of the M and $M+1$ peaks is known.

26. Which of the following compounds exhibits the pattern of m/z values shown below?
41, 43, 57, 87, 101, 116(M^+), 117($M+1$)

- a. bromoethane, C_2H_5Br
- b. 2-heptanol, $C_7H_{16}O$
- c. 2-chloropentane, $C_5H_{11}Cl$
- d. *sec*-butyl isopropyl ether, $C_7H_{16}O$

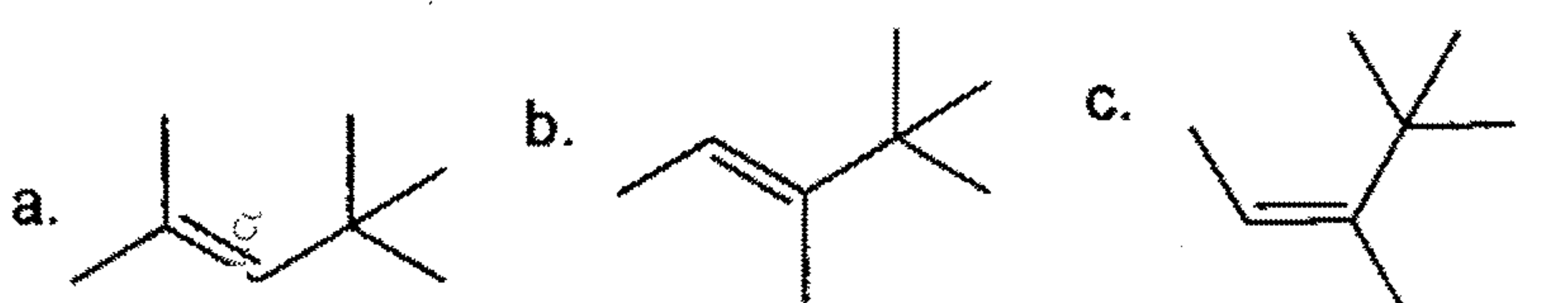
27. Including proper labels for H_A , H_B , and H_C , identify compound, $C_4H_8O_2$, with 1H NMR data as shown. This compound shows strong IR peaks at 2980 and 1740 cm^{-1} .

	δ	Approximate integration (mm)	# H	multiplicity
H_A	1.2	25	3	triplet
H_B	2.0	25	3	singlet
H_C	4.0	16	2	quartet

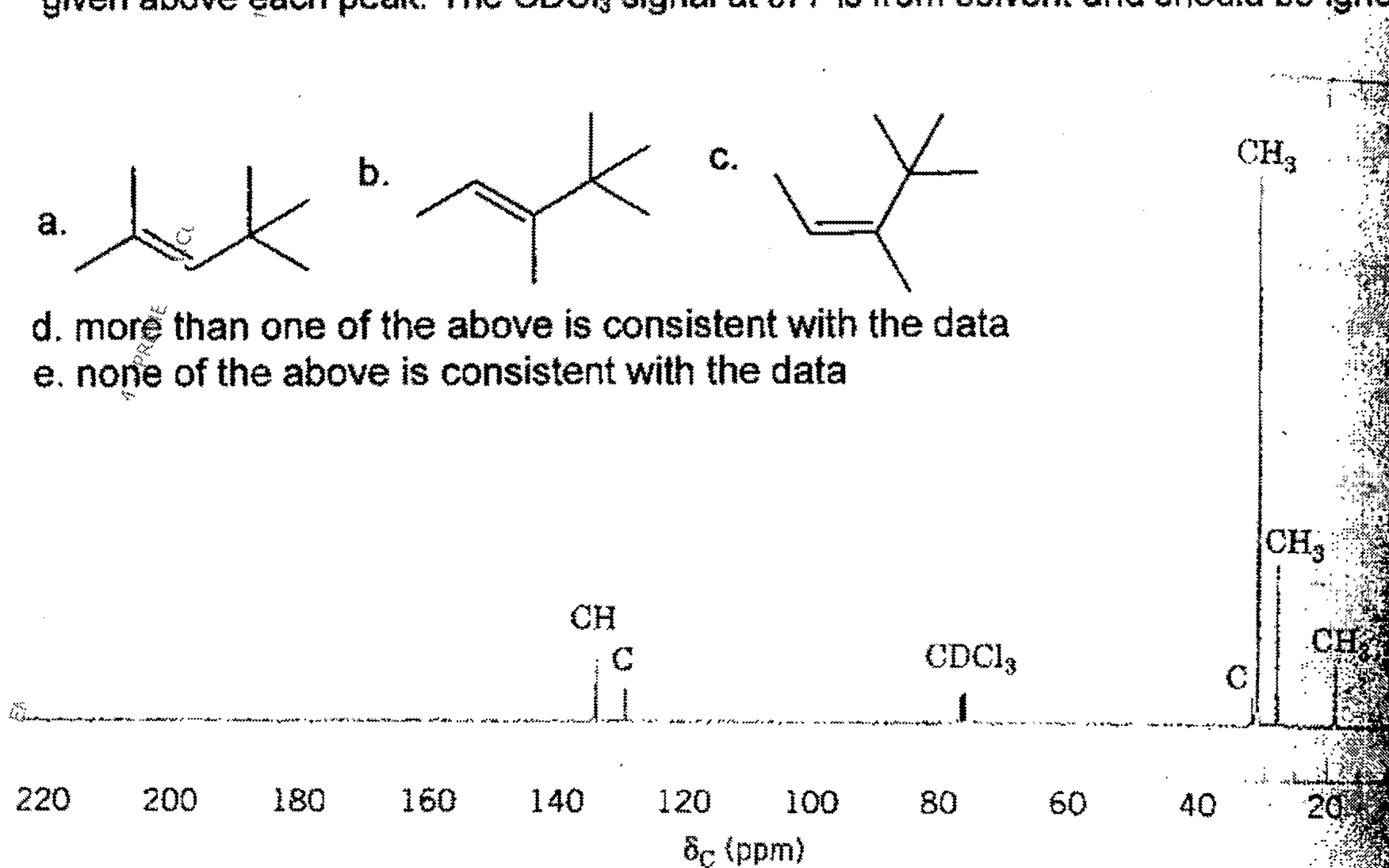


e. none of the above

28. Identify the compound, C_8H_{16} , whose ^{13}C NMR is shown. Information garnered from a separate ^{13}C DEPT spectrum of the same compound is given above each peak. The $CDCl_3$ signal at $\delta 77$ is from solvent and should be ignored.

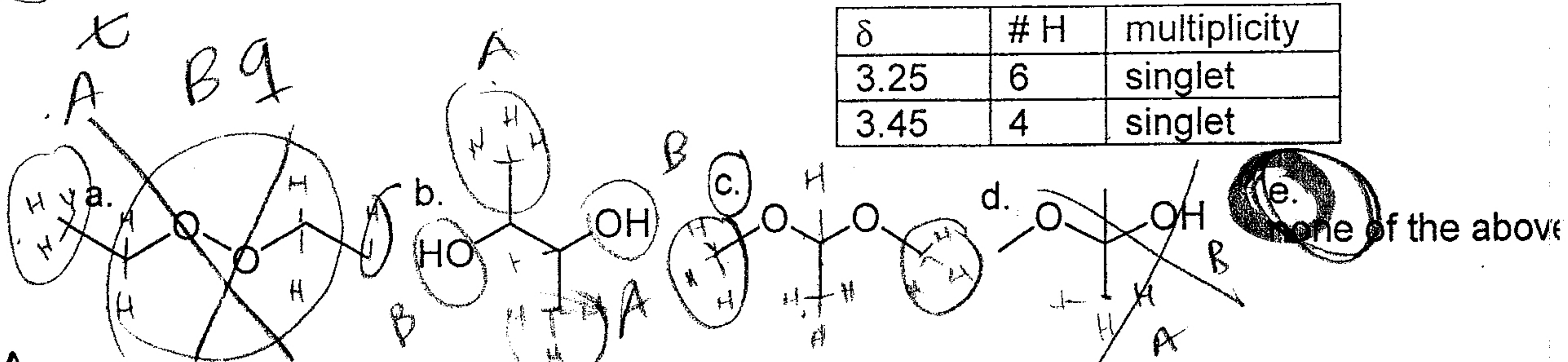


- d. more than one of the above is consistent with the data
- e. none of the above is consistent with the data



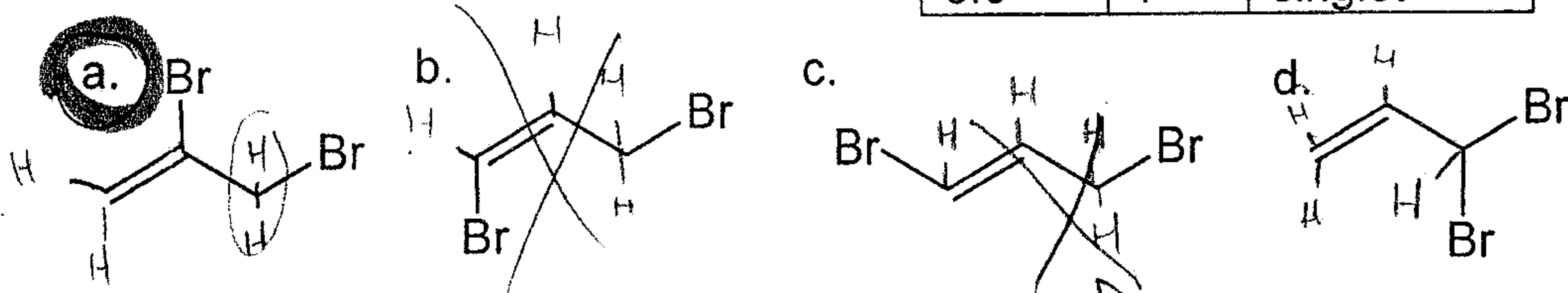
29. Identify the compound, $C_4H_{10}O_2$, with 1H NMR data as shown.

δ	# H	multiplicity
3.25	6	singlet
3.45	4	singlet



30. Identify the compound, $C_3H_4Br_2$, with 1H NMR data as shown.

δ	# H	multiplicity
4.2	2	singlet
5.6	1	singlet
6.0	1	singlet



e. more than one of the above is consistent with the data

$$u \text{ of } u = \frac{(4(2) + 2) - 12}{2}$$

$$10 + 2 - 12 = \frac{0}{2}$$

0