

九十二學年度 生命科學院 系(所) 乙 組碩士班研究生招生考試

科目 有機化學 科號 0902 共 9 頁第 1 頁 *請在試卷【答案卷】內作答

I. Choose one correct answer for each of the following questions. (此大題請於電腦卡上作答) (40%)

1) Compare the following substances in decreasing order of reactivity for β -elimination reaction: HO^- , RO^- , RCOO^- , CN^- , NO_3^-

(A) $\text{HO}^- > \text{RO}^- > \text{RCOO}^- > \text{CN}^- > \text{NO}_3^-$

(B) $\text{RO}^- > \text{RCOO}^- > \text{HO}^- > \text{NO}_3^- > \text{CN}^-$

(C) $\text{RO}^- > \text{HO}^- > \text{CN}^- > \text{RCOO}^- > \text{NO}_3^-$

(D) $\text{CN}^- > \text{NO}_3^- > \text{RCOO}^- > \text{HO}^- > \text{RO}^-$

2) Which one of the following statements is true?

(A) All chiral compounds have diastereomers.

(B) Some chiral compounds may be optically inactive.

(C) A pair of enantiomers always has a mirror-image relationship.

(D) Some diastereomers can have a mirror-image relationship.

3) Which two functional groups are present in all amino acids?

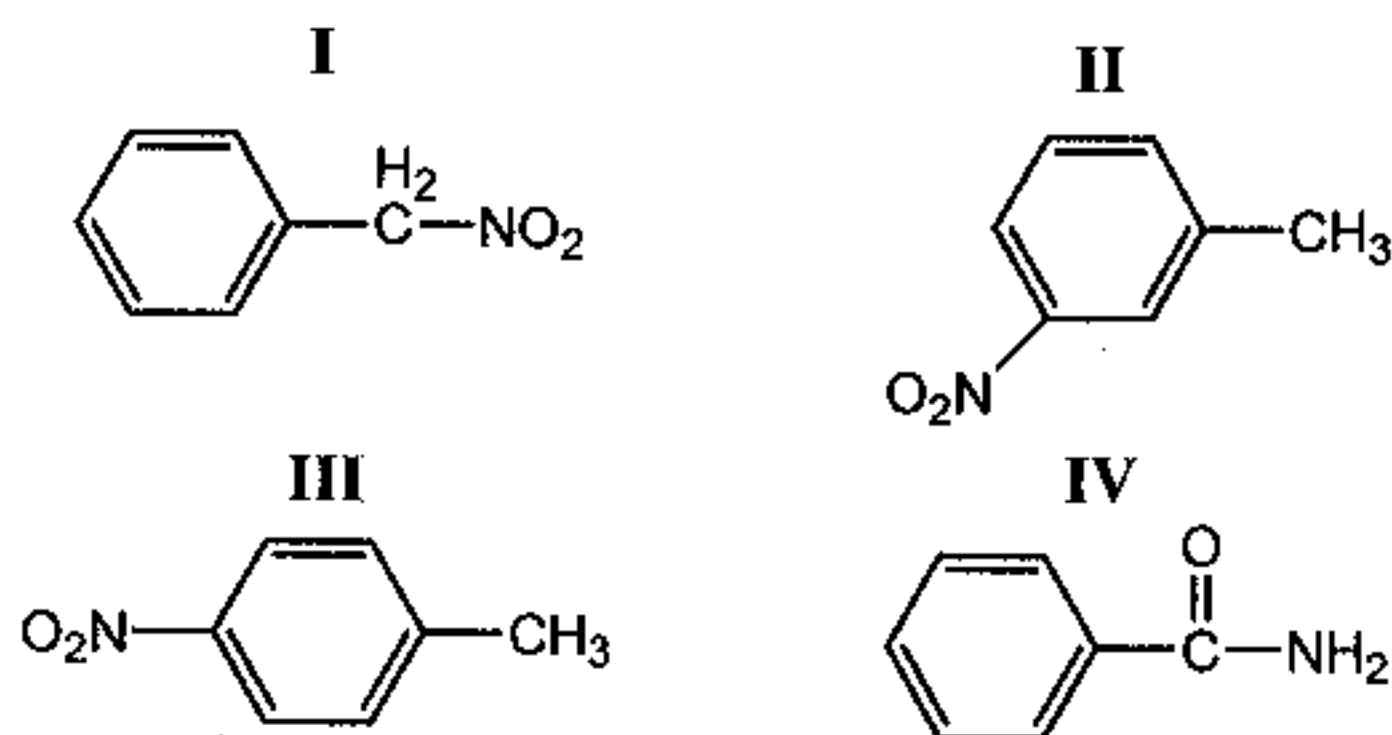
(A) alcohol, carboxylic acid

(B) alcohol, ester

(C) amine, ester

(D) amine, carboxylic acid

4) Which of the following compounds become soluble upon addition of NaOH?



(A) I, III

(B) II, IV

(C) I, IV

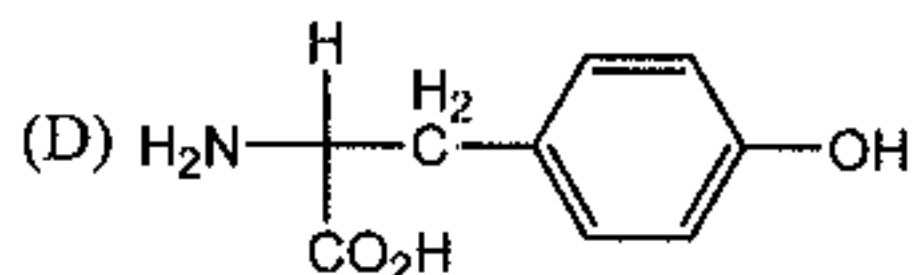
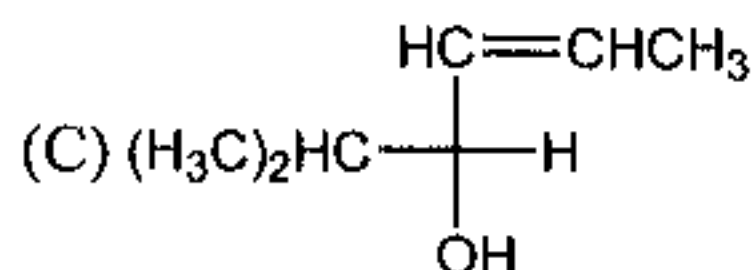
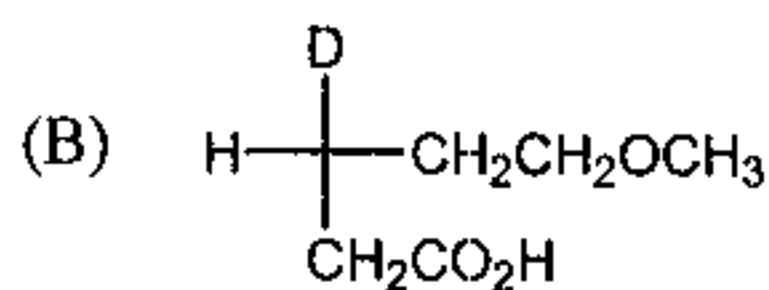
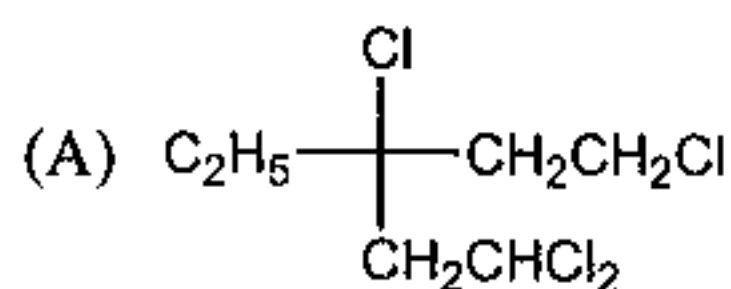
(D) II, III

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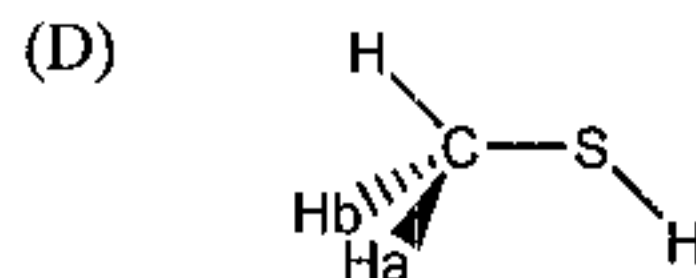
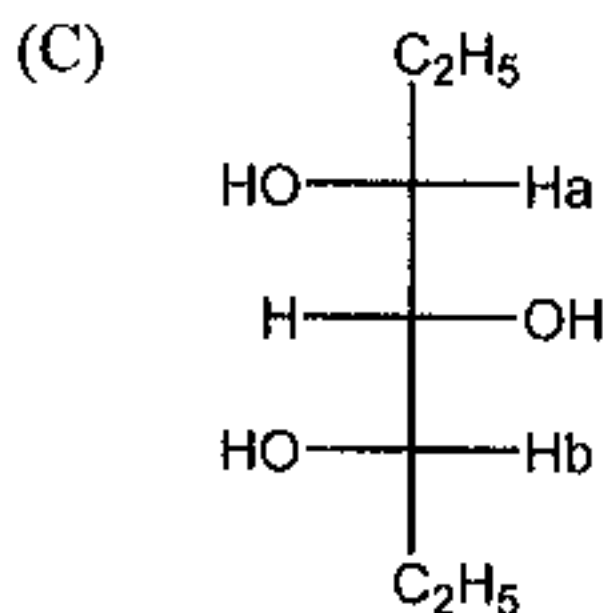
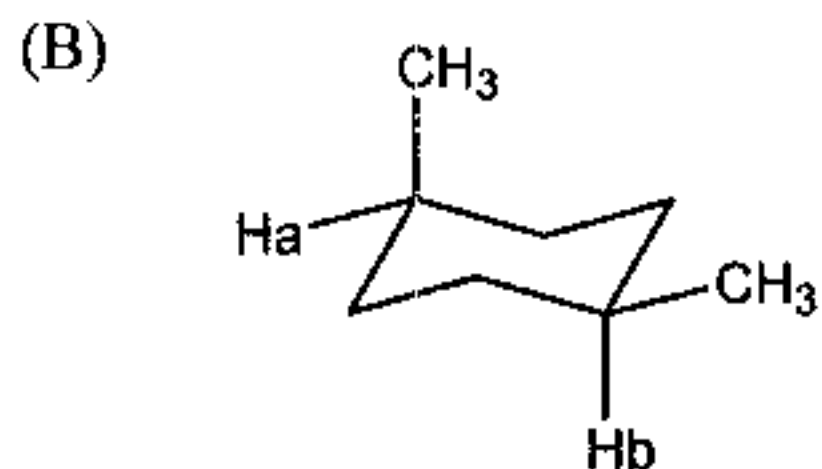
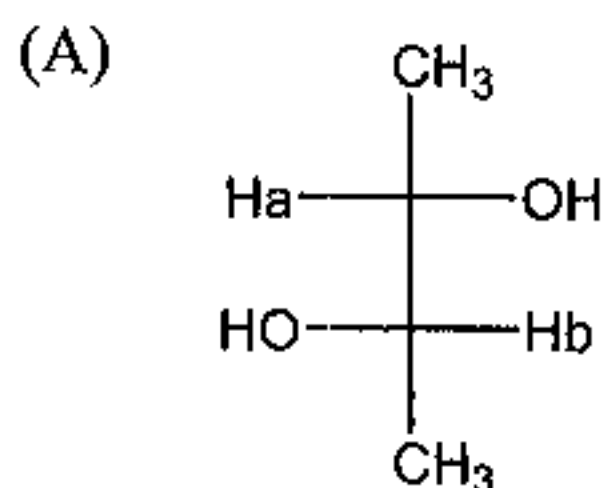
九十二學年度 _____ 生命科學院 _____ 系(所) _____ 乙 _____ 組碩士班研究生招生考試

科目 _____ 有機化學 _____ 科號 0902 共 9 頁第 2 頁 *請在試卷【答案卷】內作答

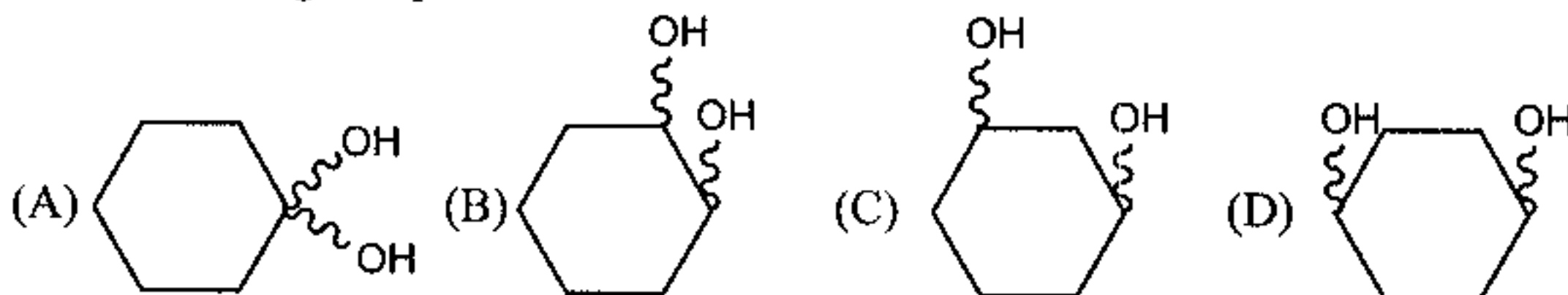
5) Which of the following compounds shows *S* configuration?



6) Which of the following compounds has enantiotopic H_a and H_b ?



7) For which of the following compounds is the *cis* form more stable than the *trans* form?



8) What is a reasonable explanation for the following observation?

Acetic acid is a stronger acid than ethanol.

I. electronegativity II. resonance III. Hybridization

- (A) I, II
(B) I, III
(C) II
(D) I

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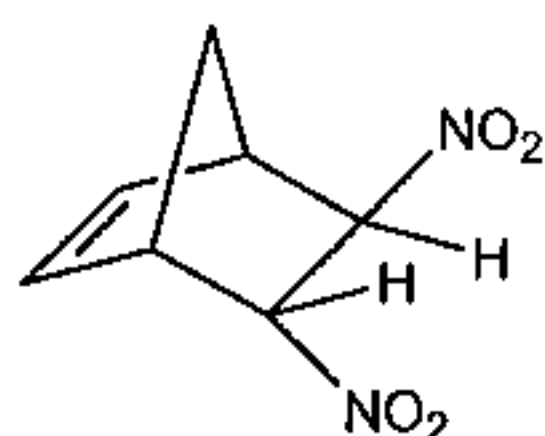
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科目 有機化學 科號 0902 共 9 頁第 3 頁 *請在試卷【答案卷】內作答

9) What is the bonding of the carbon-carbon bonds in 1,3-butadiene?

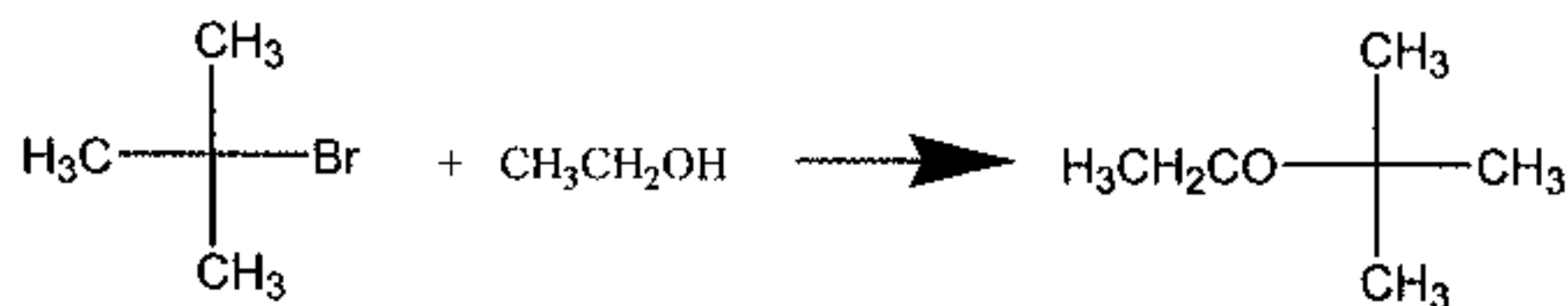
- (A) s-s, p
- (B) sp^2 - sp^2 , π
- (C) s-p, sp^2 - sp^2
- (D) sp^3 - sp^3 , p-p

10) What combination of diene and dienophile will react to form the following Diels-Alder product?



- (A) 1,3-cyclohexadiene and *cis*-dinitroethene
- (B) 1,3-cyclohexadiene and *trans*-dinitroethene
- (C) 1,3-cyclopentadiene and *trans*-dinitroethene
- (D) 1,3-cyclopentadiene and *cis*-dinitroethene

11) In the following reaction, if the concentration of t-butyl bromide and ethanol are doubled, what effect does this have on the rate of reaction?



- (A) no change
- (B) doubles
- (C) triples
- (D) quadruples

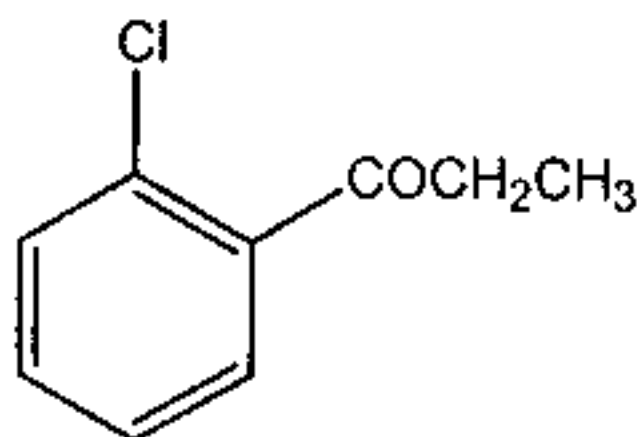
12) UV-visible spectroscopy is used mostly to detect which of the following transition?

- (A) electronic
- (B) molecular vibration
- (C) dipole changes
- (D) symmetrical changes

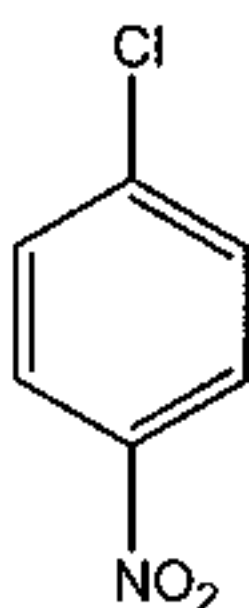
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科目 有機化學 科號 0902 共 9 頁第 4 頁 *請在試卷【答案卷】內作答

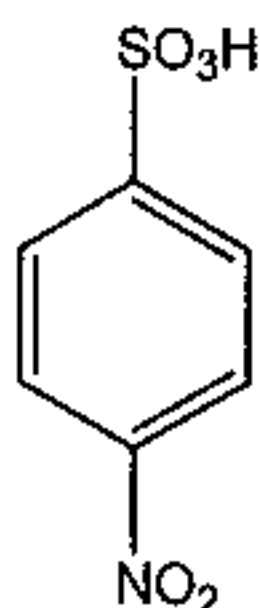
13) Which of the following compounds can be made from benzene by using two successive electrophilic substitution reactions?



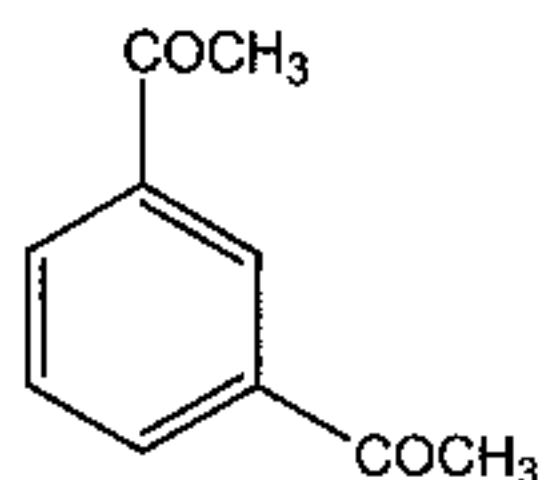
I



II



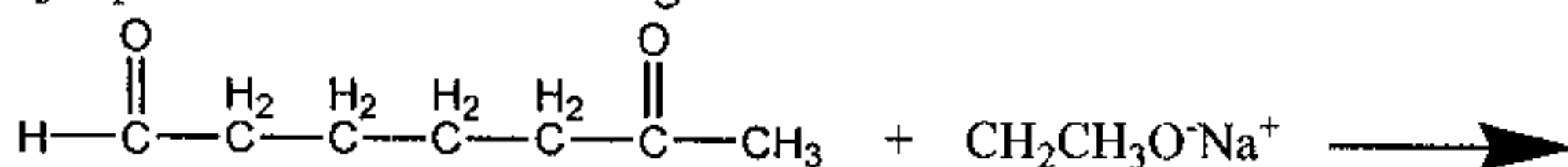
III



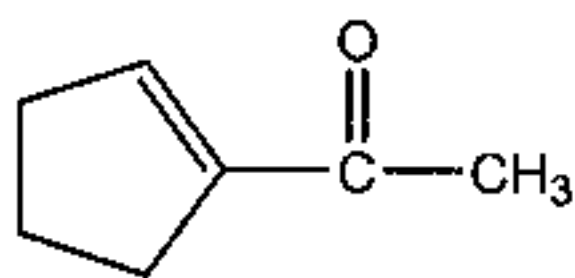
IV

- (A) I, II
(B) I, III, IV
(C) II, III, IV
(D) II, III

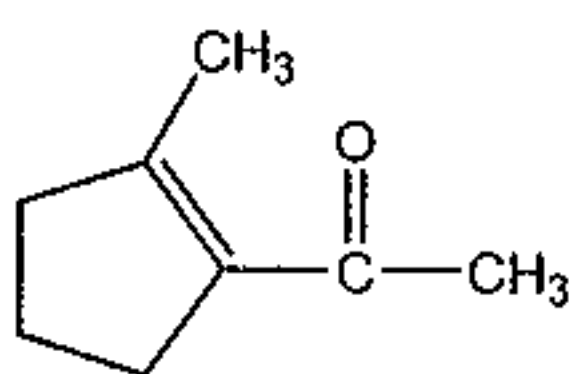
14) What is the major product from the following reaction?



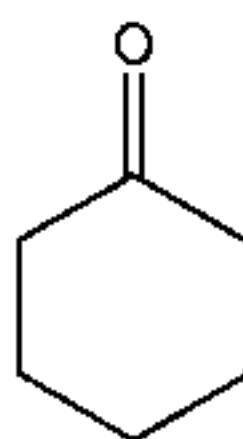
(A)



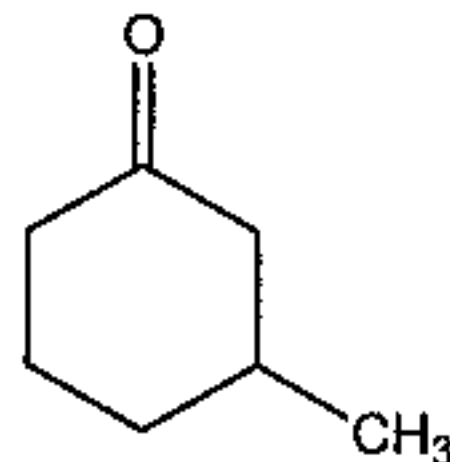
(B)



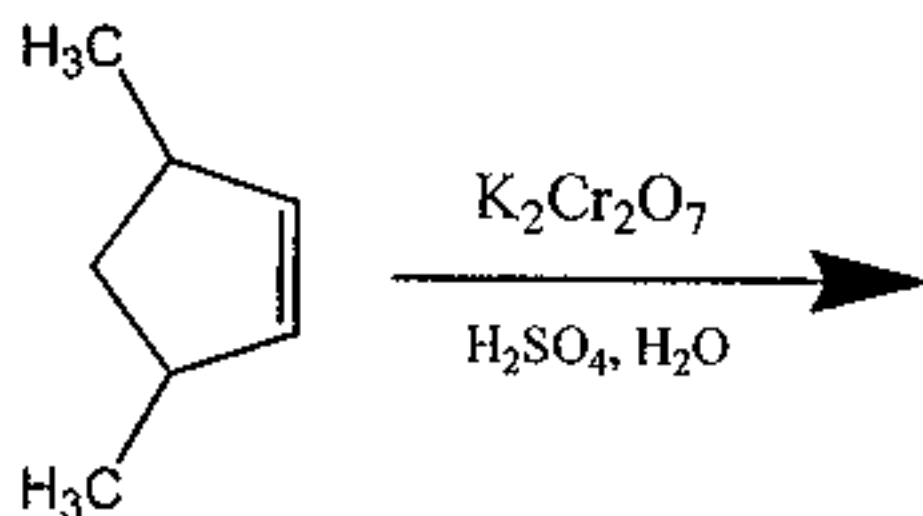
(C)



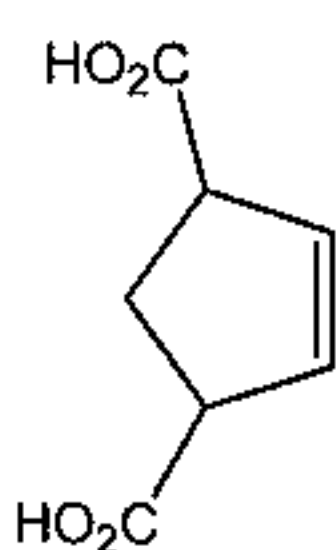
(D)



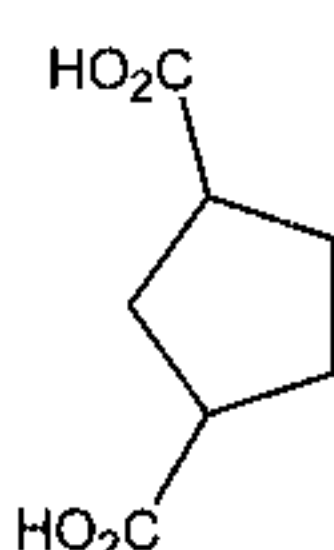
15) Which carboxylic acid is prepared from the following reaction?



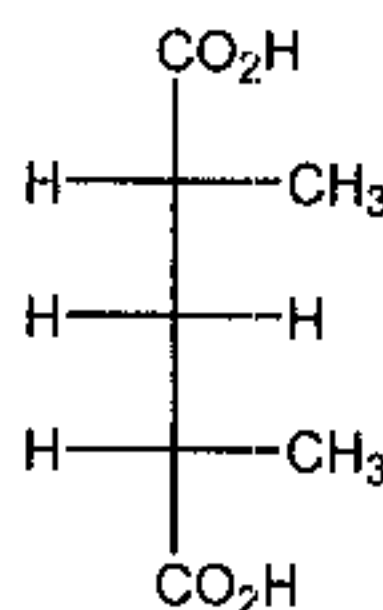
(A)



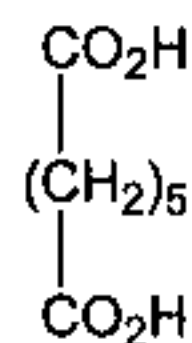
(B)



(C)



(D)

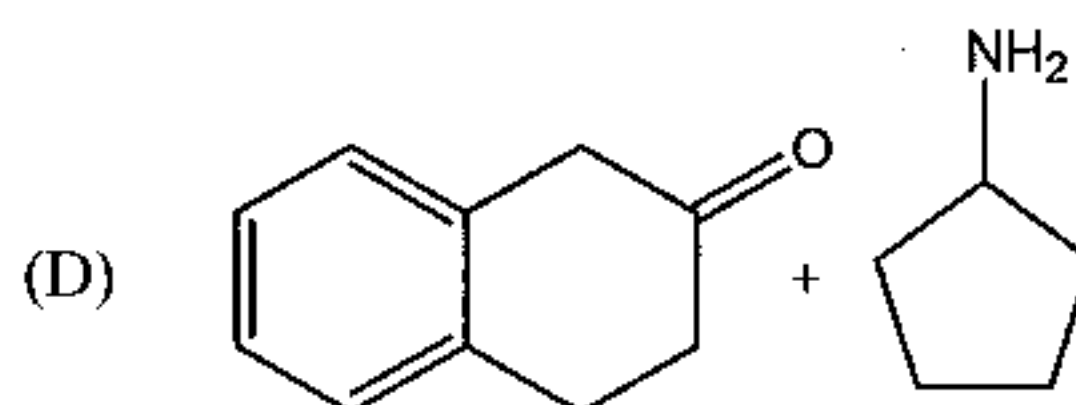
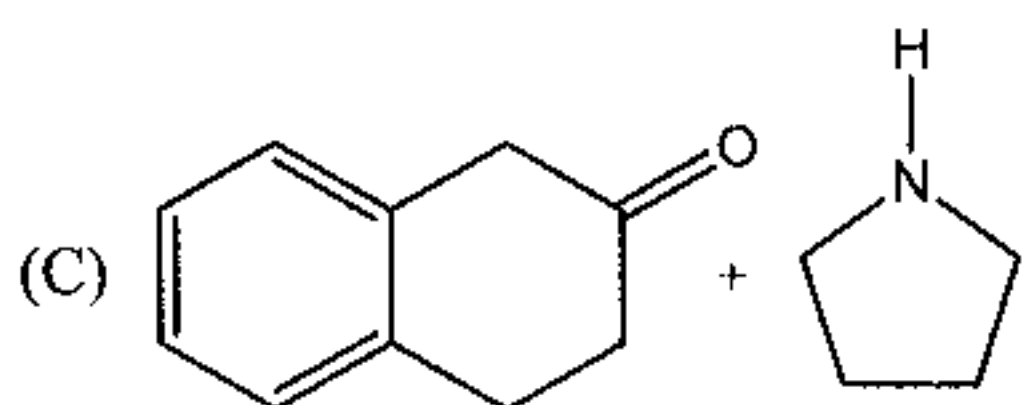
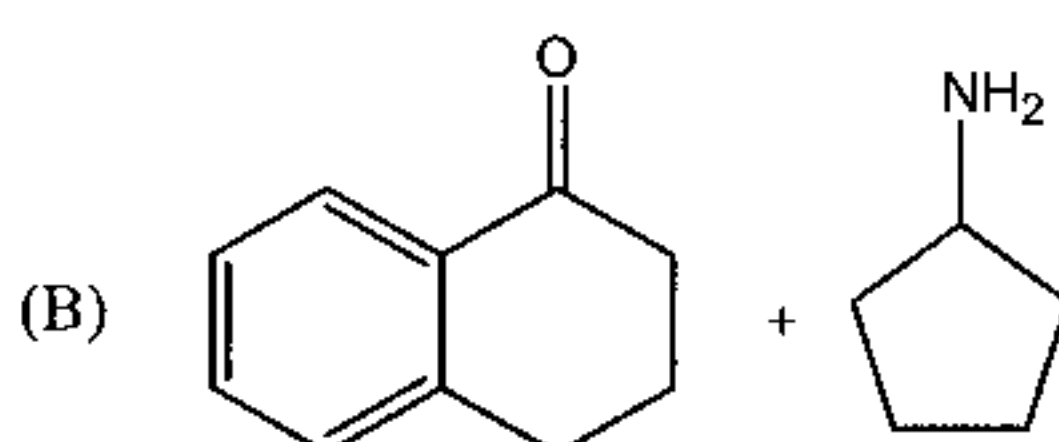
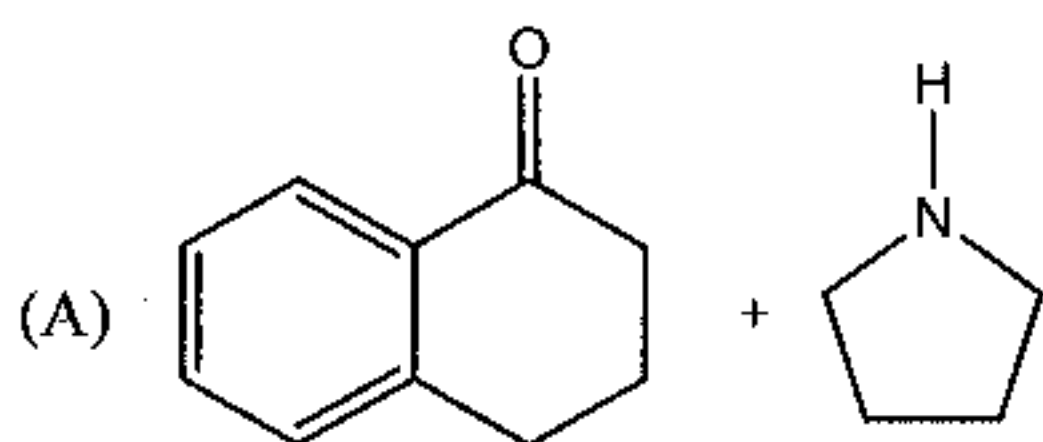
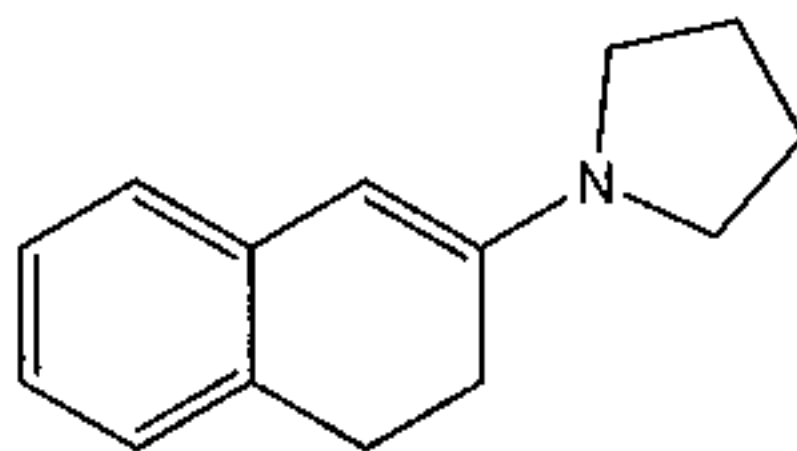


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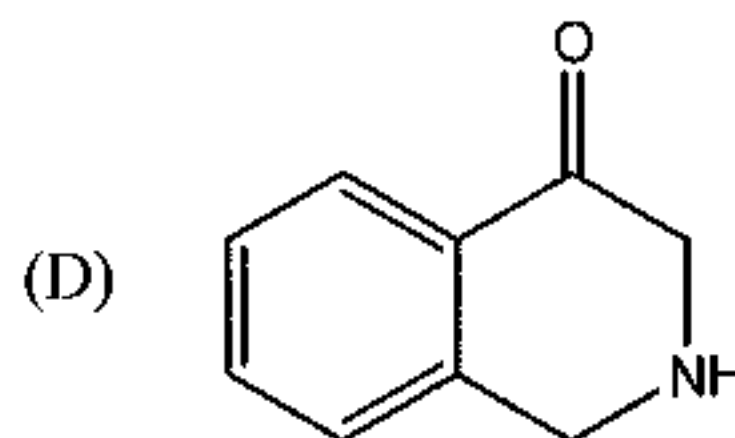
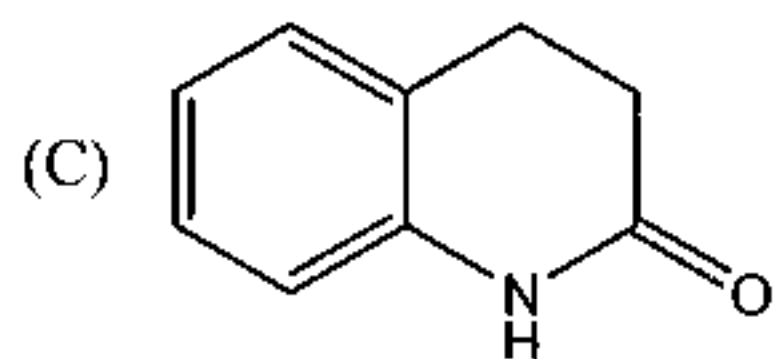
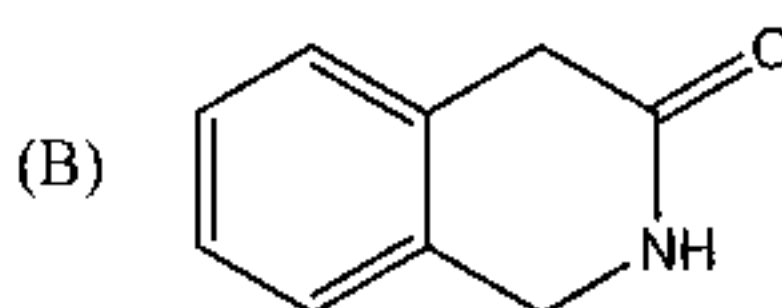
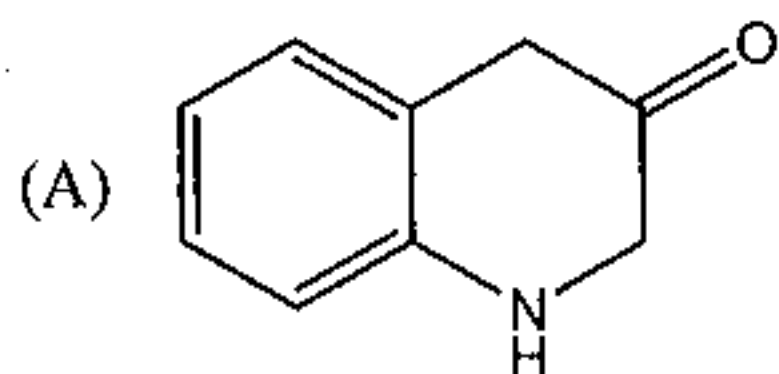
九十二學年度 _____ 生命科學院 _____ 系(所) _____ 乙 _____ 組碩士班研究生招生考試

科目 _____ 有機化學 _____ 科號 0902 _____ 共 9 _____ 頁第 5 _____ 頁 *請在試卷【答案卷】內作答

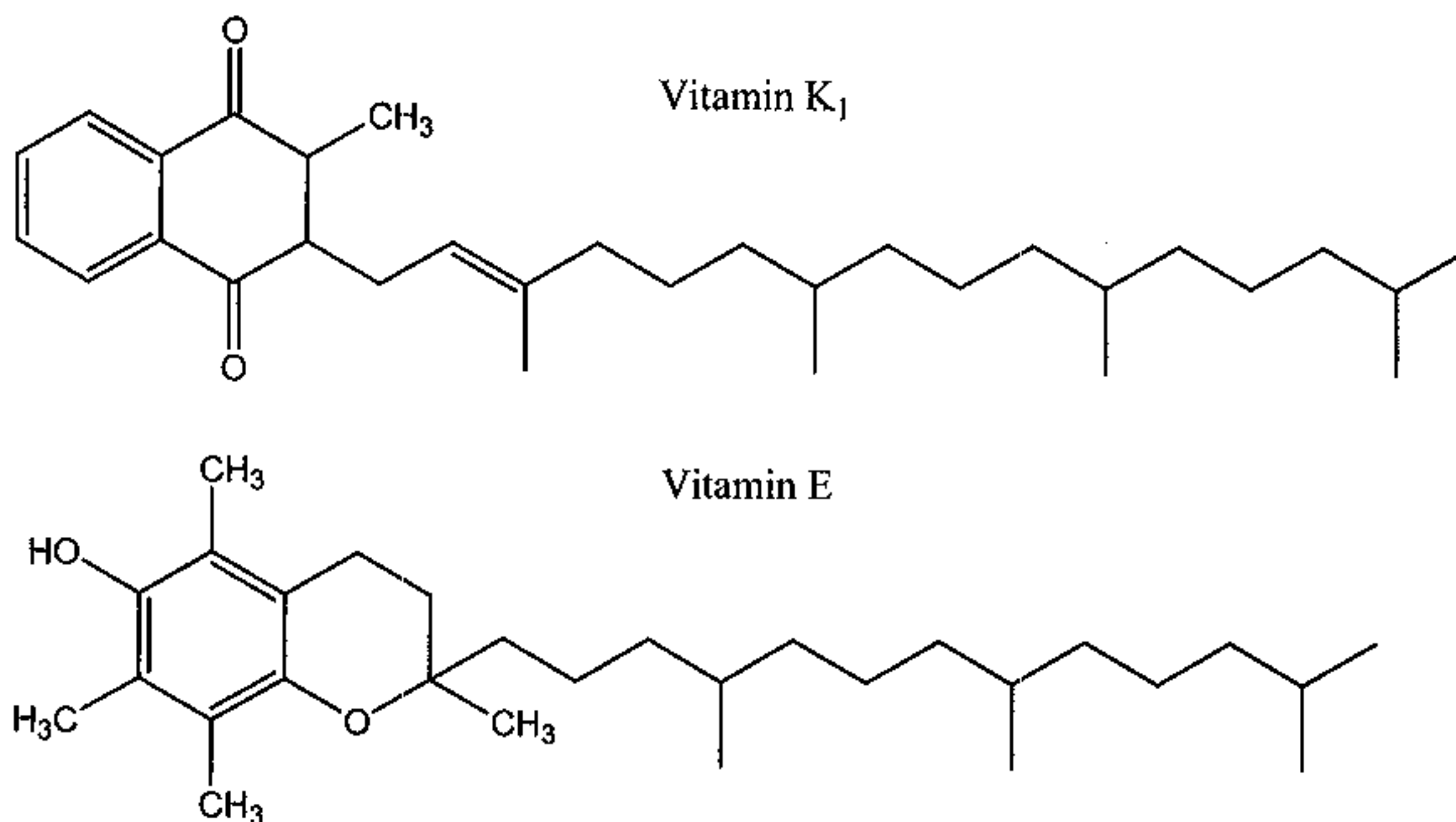
16) What are the reactants in the enamine synthesis of the following compound?



17) Which of the following compounds is the strongest base?



- 18) What common structural features of vitamin E and vitamin K₁ account for the greater solubility of these molecules in dichloromethane than in water?



- (A) a quinone/hydroquinone unit
 (B) oxygen atoms
 (C) 4 isoprene units
 (D) aromatic rings
- 19) Fats, oils, waxes, phospholipids, prostaglandins and steroids all have in common which of the following properties?
 I. oxygen functionality II. nonpolar groups III. polar groups IV. unsaturation
 (A) I, II
 (B) III, IV
 (C) I, III
 (D) II, IV
- 20) What are the most likely products from the following reaction sequence?



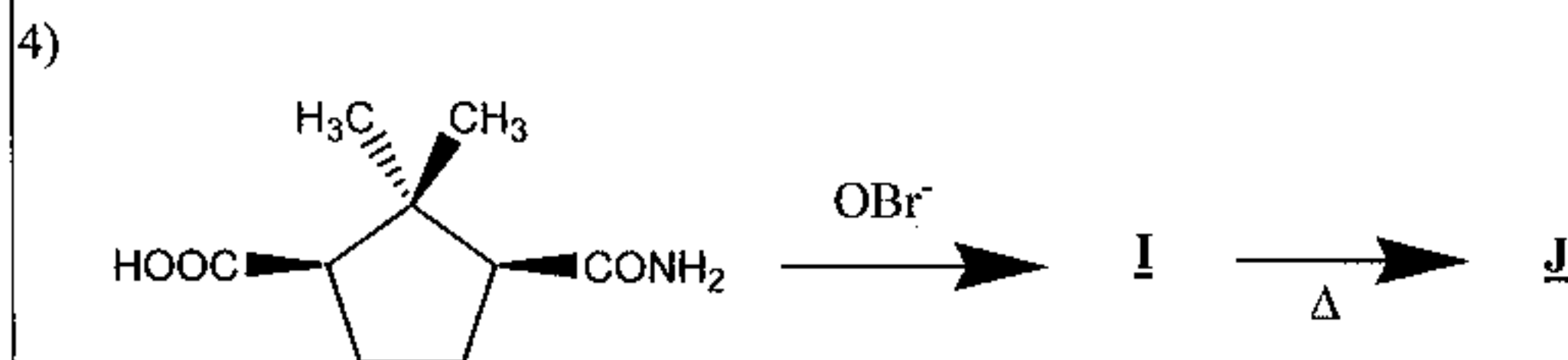
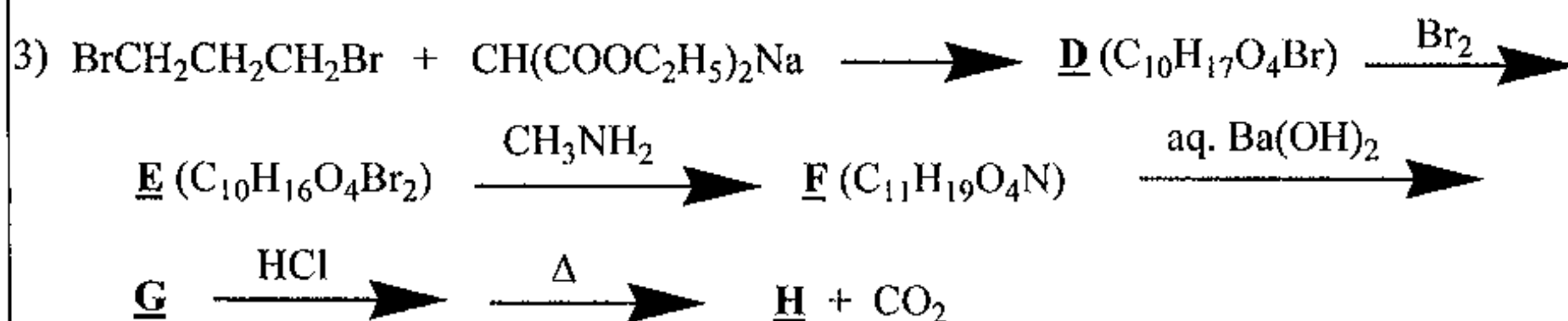
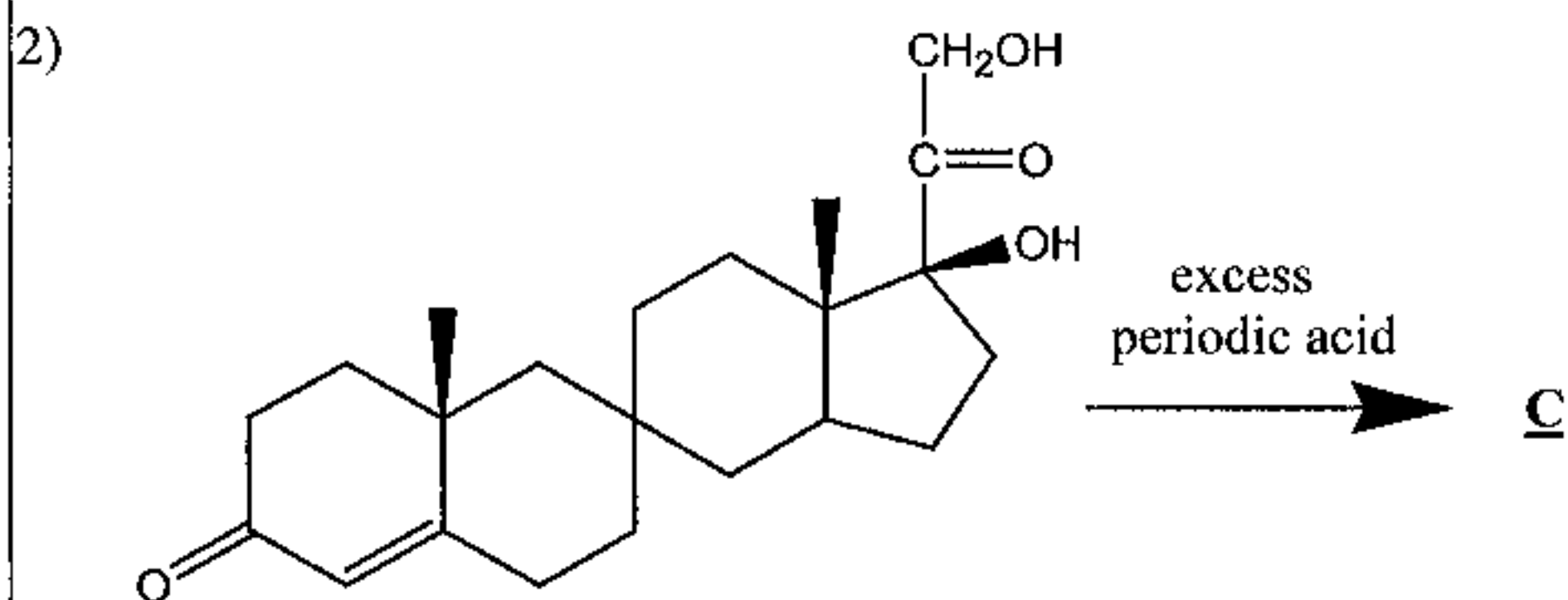
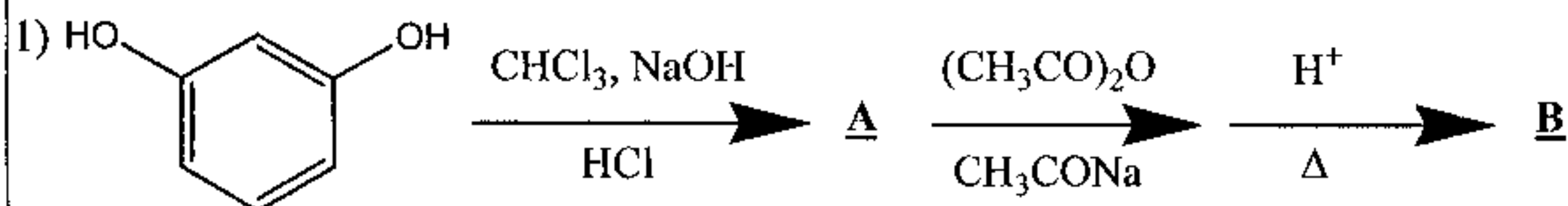
- (A) gly-val and val-val
 (B) val-gly and val-val
 (C) gly-gly and gly-val
 (D) gly-val and val-gly

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科目 _____ 有機化學 _____ 科號 0902 共 9 頁第 7 頁 *請在試卷【答案卷】內作答

II. Please draw structures of the major product for each of following reactions. (20%)



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 科目_____有機化學_____科號_____0902_____共_____9_____頁第_____8_____頁 *請在試卷【答案卷】內作答

III. Determine the structures of A, B, C, D, E based on their spectroscopic data. (20%) Detailed assignment on specific functional groups need to be shown in your answer.

A) $C_6H_{10}O_2$

1H NMR: δ 1.2 (6H, s); δ 2.2 (3H, s); δ 9.8 (1H, s)

IR: 1737 cm^{-1} ; 2742 cm^{-1} ; 2820 cm^{-1}

B) $C_{10}H_{12}O$

1H NMR: δ 1.1 (6H, d); δ 3.5 (1H, multiple); δ 7.7 (5H, multiple)

IR: 1689 cm^{-1}

C) $C_2H_3Br_3$

1H NMR: δ 5.75 (1H, t); δ 4.16 (2H, d)

D) $C_{17}H_{20}N_2O$

1H NMR: δ 3.1 (s, A=3); δ 6.7-8.0 (m, A=2)

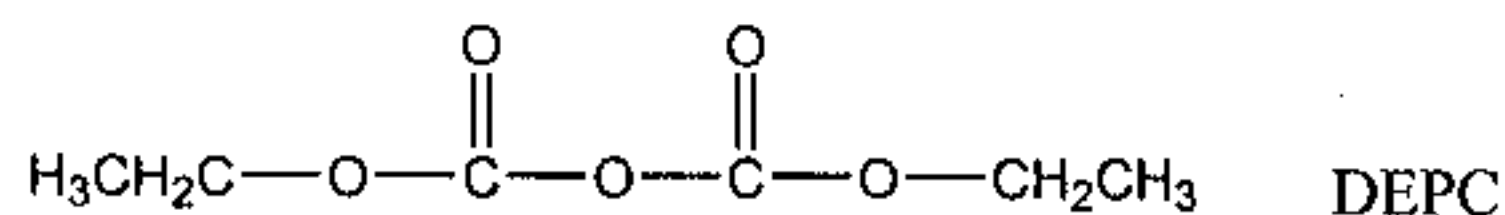
IR: 1180 cm^{-1} ; 1310 cm^{-1} ; 1380 cm^{-1} ; 1665 cm^{-1}

E) C_9H_{20}

$m/e = 43$ (100%), 57 (50%), 71 (25%), 85 (18%), 113 (10%), 128 (M^+)

IV. Briefly answer each of the following questions and propose a rational reaction mechanism for questions 1, 2, and 3. (20%, 4% each)

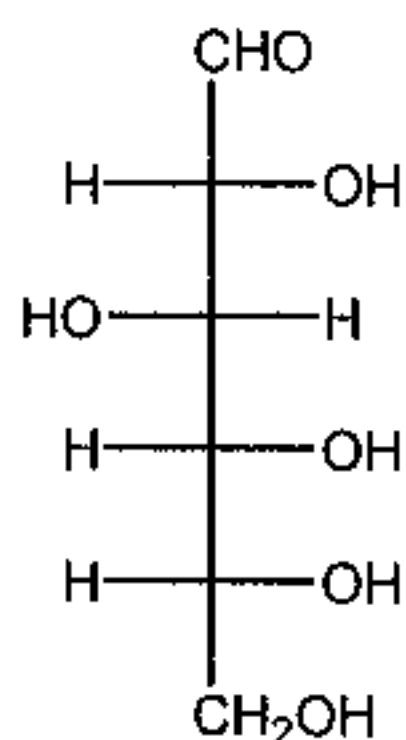
- 1) When a peptide reacts with cyanogen bromide (CNBr) in aqueous HCl, the peptide bond is cleaved specifically at the carboxy side of each methionine residue.
- 2) It is known that histidine residues are the active site residues of RNases. When one wants to purify RNA, all buffers or reagents need to be treated with Diethylpyrocarbonate (DEPC) to inhibit the RNase activity.



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4) D-glucose (aldehyde form) possesses the following Fischer projection.



- b) How many asymmetric carbons are there in D-glucose? What are their configurations?
- c) The aldehyde form of glucose usually exists as its cyclic pyranose form. Please draw the Haworth projection of α D-glucopyranose.

5) A common pH indicator Congo Red is red in basic or neutral solution, and blue in acid solution. The neutral form of the dye is shown as the following structure. Suggest a structure for the blue form of the dye, assuming that it is a dication.

