國立清華大學 102 學年度碩士班考試入學試題

系所班組別：生命科學院乙組(0505)、醫學生物科技學程(0507)

考試科目（代碼）：有機化學(0502、0706)

　*請在【答案卷】作答

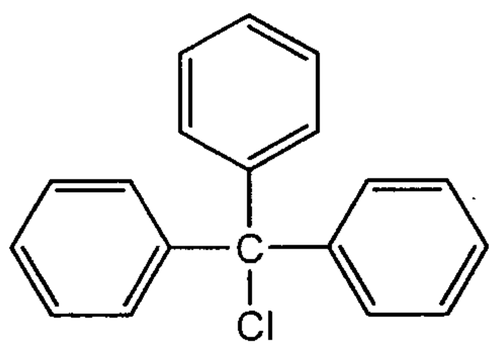
1. Please select 1 correct answer from each of the following questions **(30%)**

(1) Place the following positions in the order of increasing reactivity in a nucleophilic reaction.

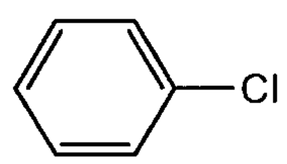
I. *N*-7 of guanine　II. *N*-3 of adenine　III. *N*-1 of cytosine

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

(2) Which functional groups of DNA will be protected by the following structures during synthesis?



I



II

(A) I for amine, II for 5' hydroxyl

(B) II for amine, I for 5' hydroxyl

(C) I for 3' nucleoside, II for 5' nucleoside

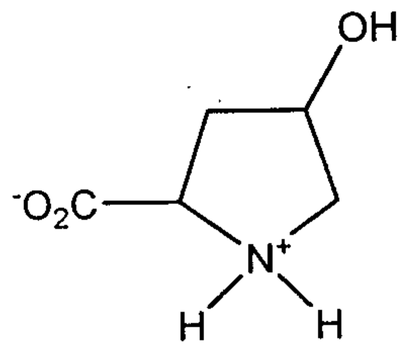
(D) I for 5' nucleoside, II for 3' nucleoside

(3) What is the structure of a pentapeptide that gives Lys-Leu-Phe on reaction with cyanogen bromide, and gives fragments Met-Lys, Leu-Lys, Leu-Phe and Arg on reaction with trypsin?

(A) Arg-Met-Phe-Leu-Lys　(B) Lys-Leu-Phe-Arg-Met

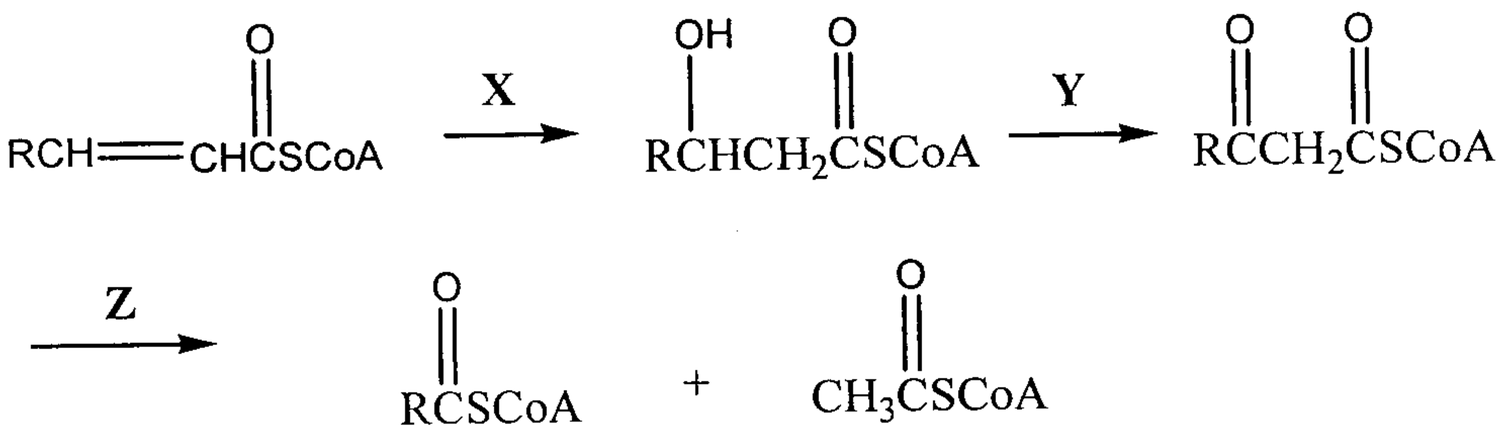
(C) Arg-Met-Lys-Leu-Phe　(D) Met-Arg-Lys-Leu-Phe

(4) How many steroisomers are possible for the following amino acid?



(A) 2　　(B) 4　　(C) 8　　(D) none

(5) The following are key steps in fatty acid metabolism. What is the best description for third step (Z)?

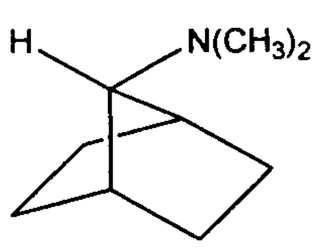


(A) oxidation　　(B) Michael addition
(C) retro-Claisen reaction　　(D) selective reduction

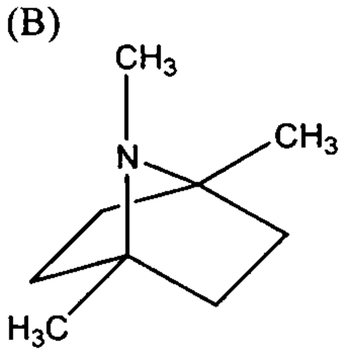
(6) How many triglycerides including stereoisomers are possible to have 3 different acyl groups?
(A) 4　　(B) 6　　(C) 6　　(D) 12

(7) An unknown compound has the molecular formula $C_9H_{17}N$. It reacts with excess methyl iodide to give another compound, $C_{10}H_{20}NI$. Treatment of this compound with silver oxide followed by heating converts it into another compound $C_{10}H_{10}N$. When this last compound is treated successively with methyl iodide and then heated, two compounds are generated C_8H_{12} and C_3H_9N. What is a likely structure for the original unknown compound?

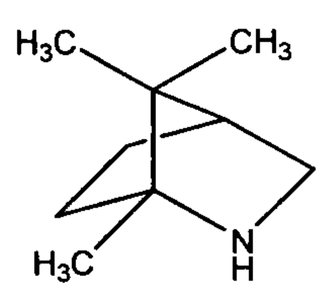
(A)



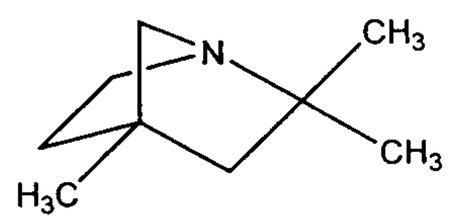
(B)



(C)



(D)



(8) Which of the following halides is used to alkylate ethyl acetoacetate in order to prepare 4-methyl-5-phenyl-2-pentanone?

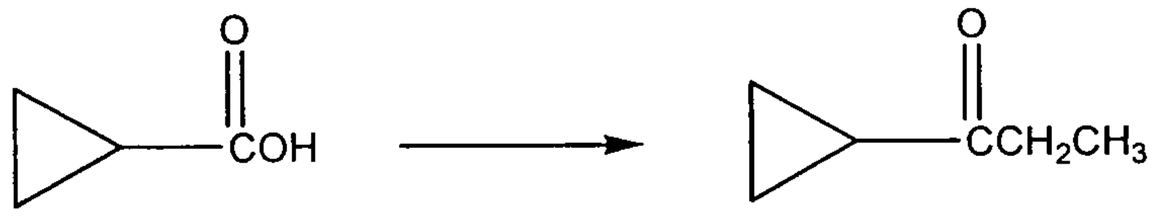
(A) 2-bromo-1-phenylpropane

(B) 1-bromo-2-methyl-3-phenylpropane

(C) benzyl bromide and methyl bromide

(D) 1-bromo-2-phenylethane and methyl bromide

(9) What are the best conditions for the following preparation?



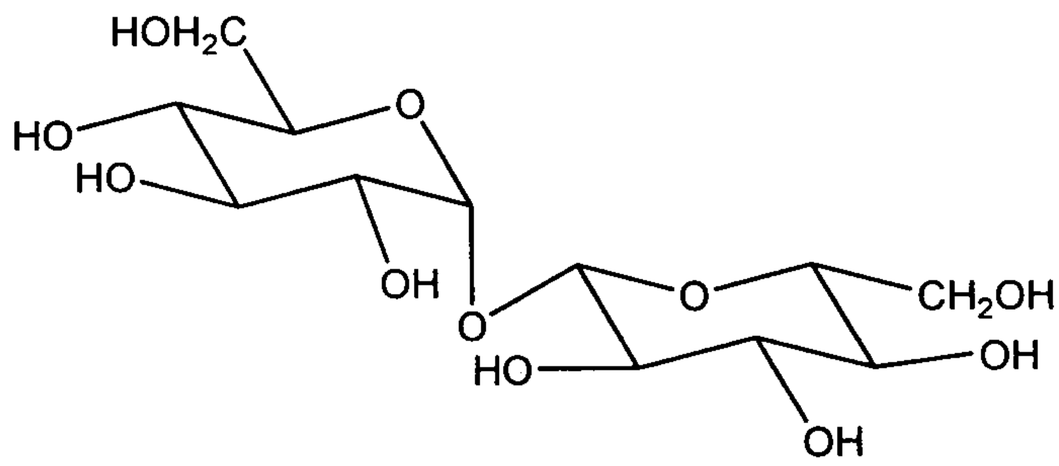
(A) $SOCl_2$; $(CH_3CH_2)_2Cd$

(B) $SOCl_2$; CH_3CH_2MgBr

(C) $LiALH_4$: $SOCl_2$: Mg, ether; CH_3CHO

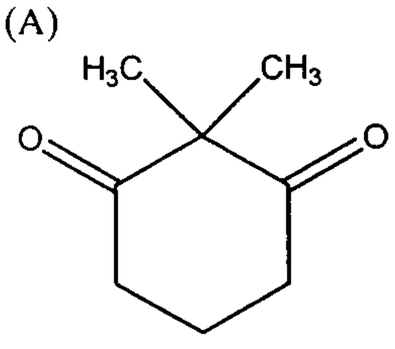
(D) CH_3OH, H_3O^+; $LiAlH_4$

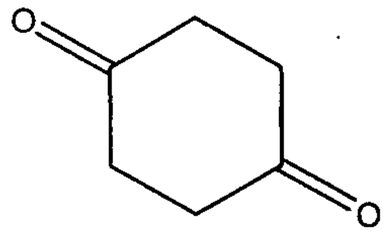
(10) Which of the statements about the following sugar are true?

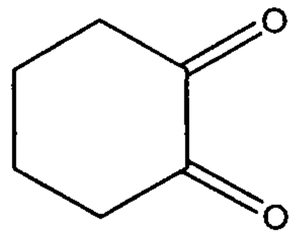


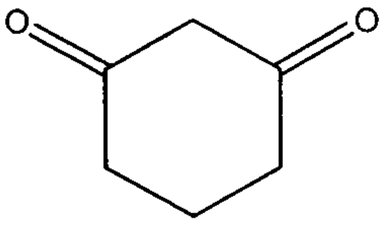
I. It is a reducing sugar　　**II.** It will undergo mutarotation
III. The linkage is 1,1　　**IV.** It is composed of 2 units of D-glucose
(A) I, II　　(B) II, III　　(C) III, IV　　(D) I, IV

(11) Which of the following compounds undergoes the fastest exchange of hydrogen for deuterium when treated with D_2O and a trace of ^-OD?

(A)


(B)


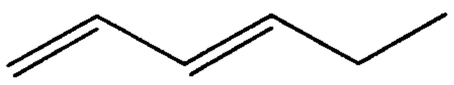
(C)


(D)


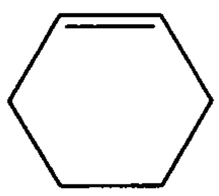
(12) Which of the following groups is an *ortho-para* director?
(A) $-OCOCH_3$　　(B) $-COOCH_3$　　(C) $-CHO$　　(D) $-COOH$

(13) A compound has a molecular weight of 82 and a UV maximum at about 220 nm. The proton NMR has 3 sets of signals and the IR has a band at 3030 nm and another at 1680 nm. What is the most likely structure for the compound?

(A) $H_3CH_2CC{\equiv}CCH_2CH_3$

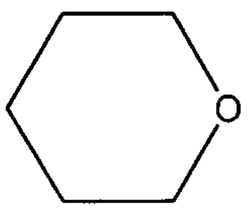
(B) 

(C) 

(D) 

(14) Compound A ($C_5H_{12}O$) has a mass spectrum with no peak higher than 70 and the base peak is located at 45. What is the most likely structure for compound A?

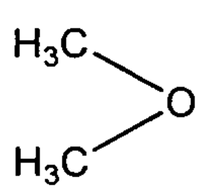
(A) $CH_3(CH_2)_4OH$

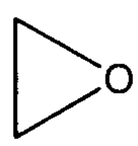
(B) 

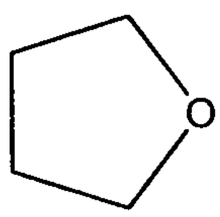
(C) $CH_3(CH_2)_2OCH_2CH_3$

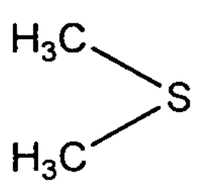
(D) $CH_3CHCH_2CH_2CH_3$ (OH)

(15) Place the following compounds in the order of increasing base strength.

I 

II 

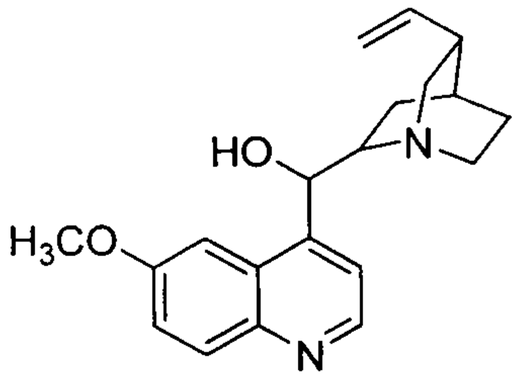
III 

IV 

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

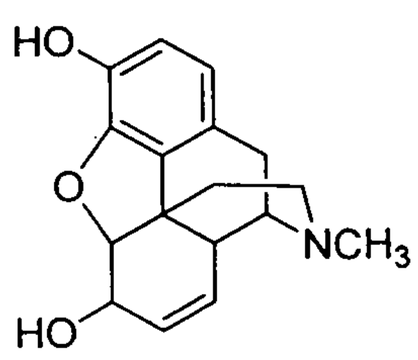
2. Identify the chirality centers in each of the following molecules. **(6%)**

A



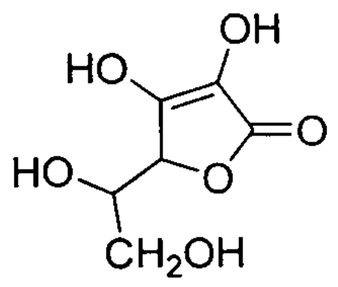
Quinine

B



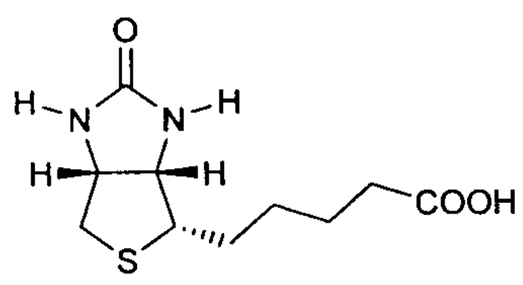
Morphine

C

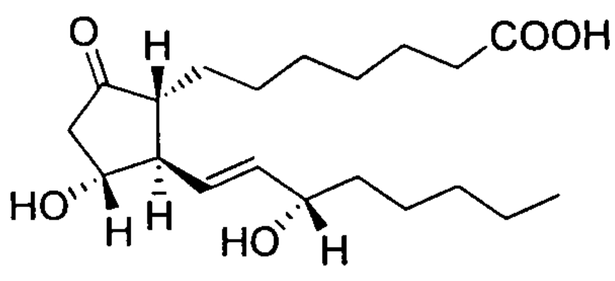


Ascorbic acid

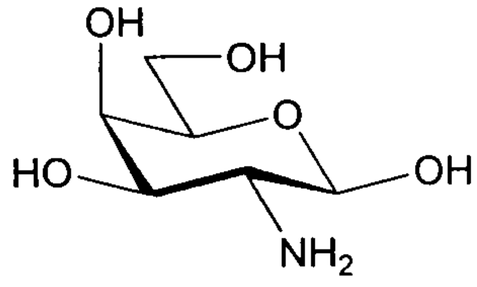
3. Please assign the *R* and *S* configurations to the chirality centers in each of the following molecules. **(6%)**



Biotin



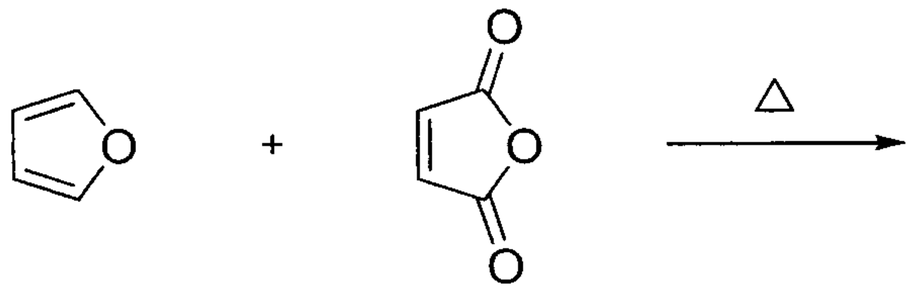
Prostaglandin E_1



Galactosamine

4. Please predict the major product of the following reaction. **(6%)**

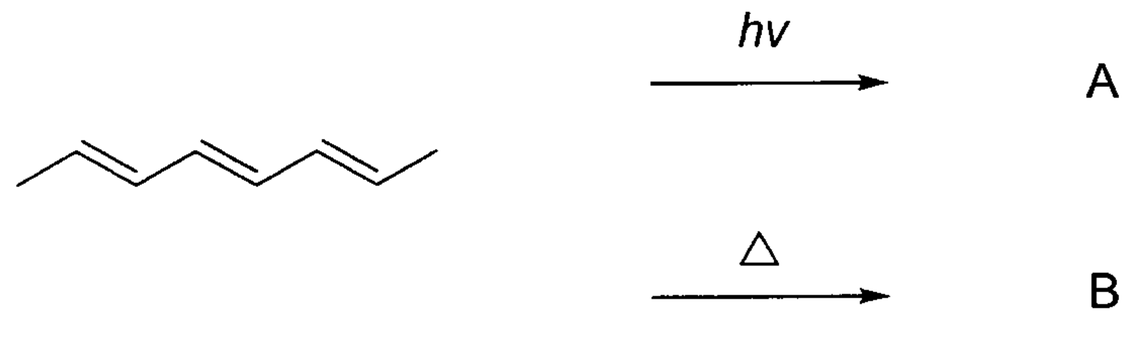
5. Please predict the product of the following reaction. **(4%)**



A endo-adduct

B exo-adduct

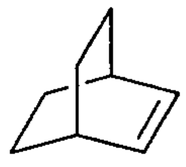
6. Please predict the product of the following reaction. **(4%)**



A

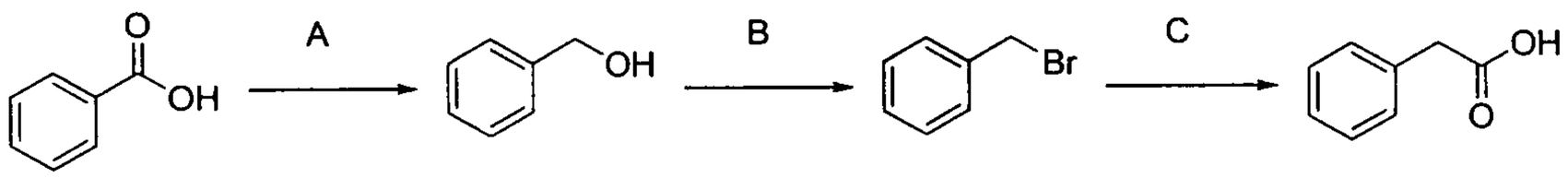
B

7. What are the products of reaction of following compound with: **(6%)**

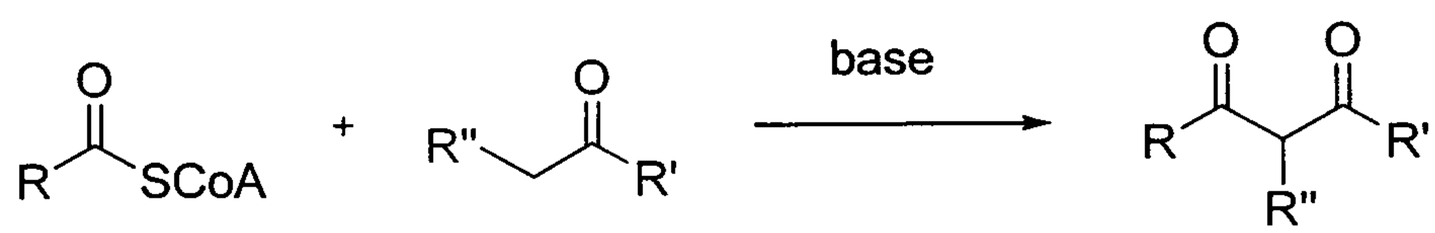


A. Bromine in CCl_4
B. OsO_4, then $NaHSO_3$
C. 3-chloroperbenzoic acid, then aqueous acid
D. H_2/Pt

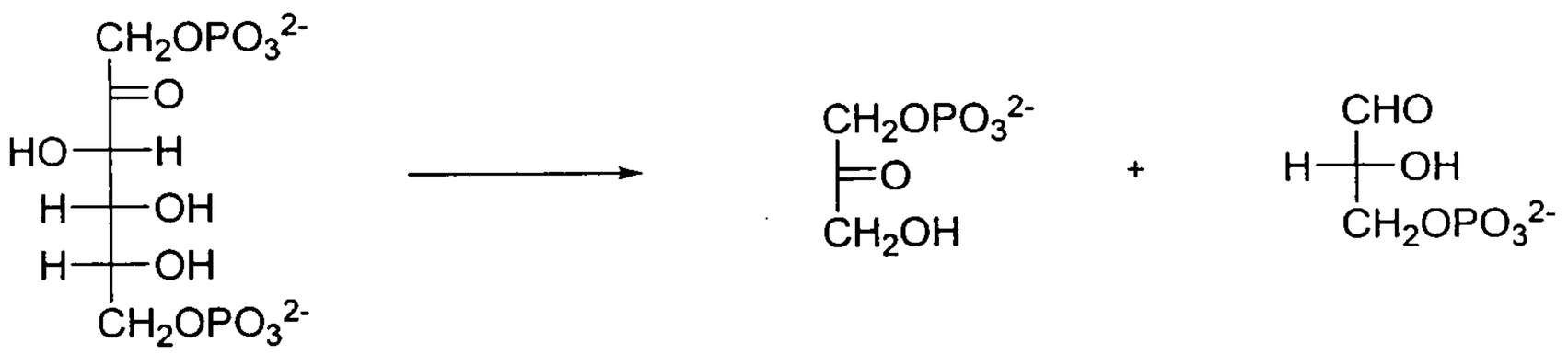
8. Please provide the requested products or reagents. **(6%)**



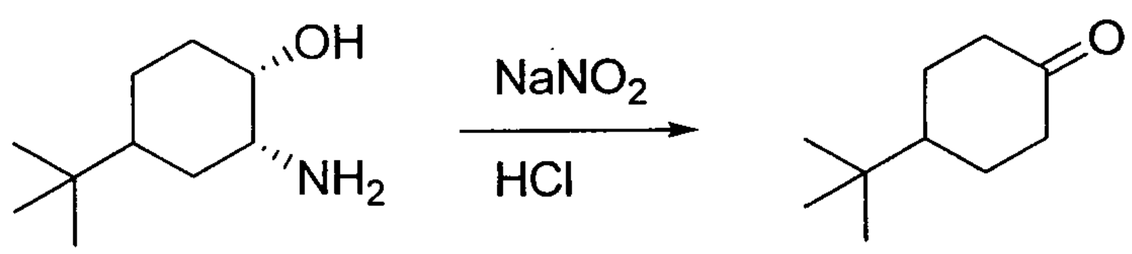
9. Please complete the following biological mechanisms by adding curved arrows to indicate electron flow: **(3%)**



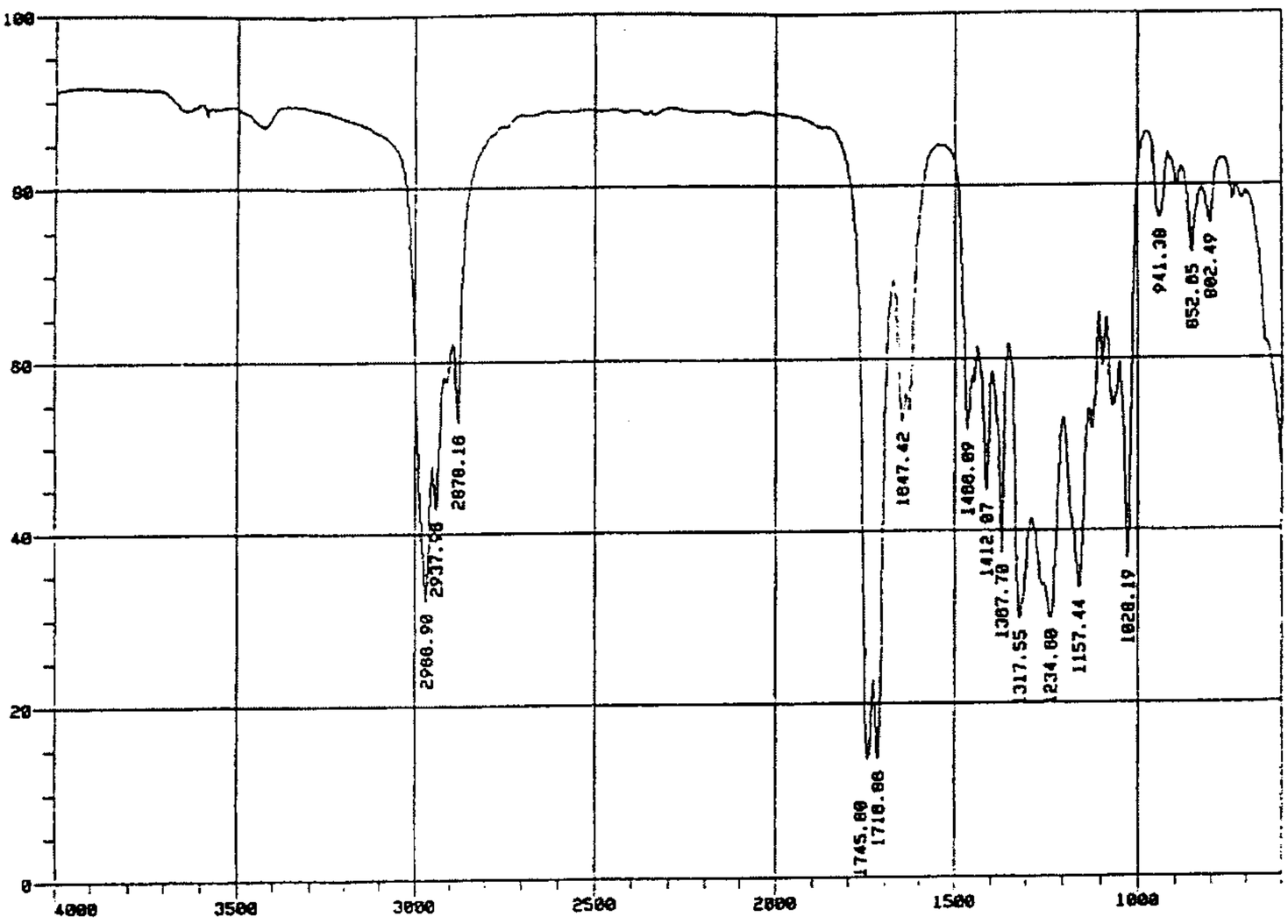
10. Please propose a mechanism of the fructose degradation by glycolysis pathway. **(3%)**

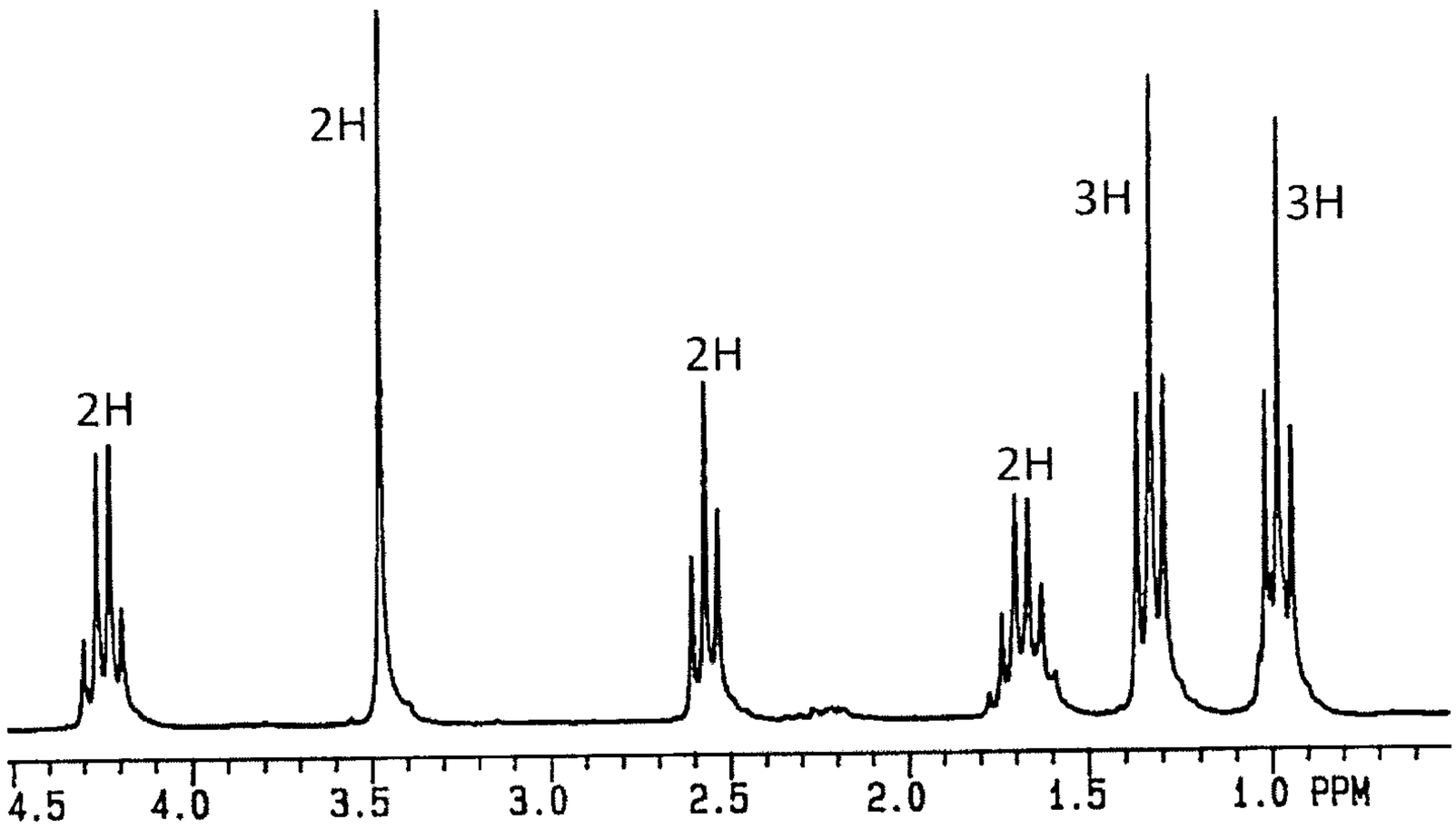


11. Please propose a mechanism of the following reaction. **(6%)**

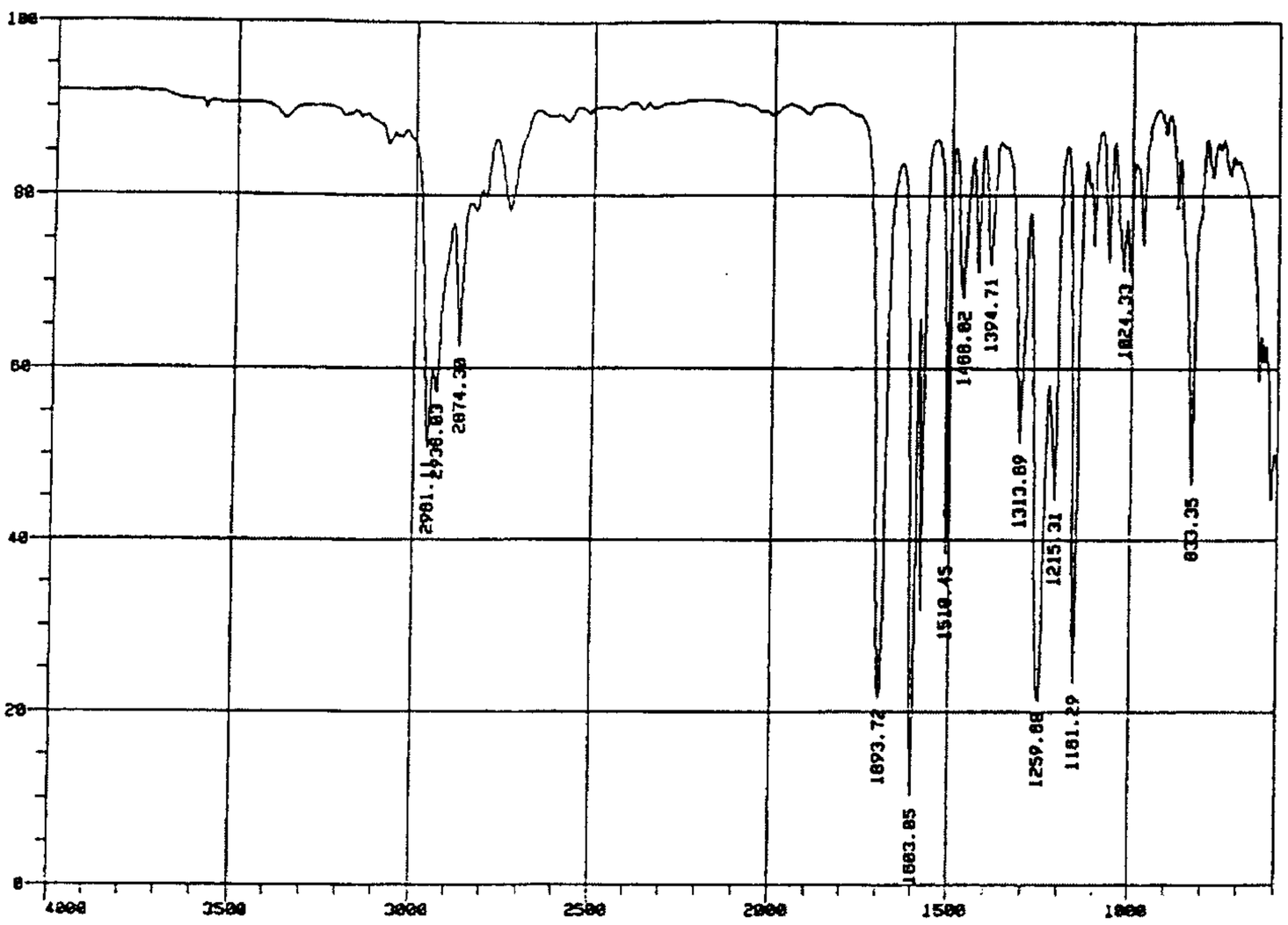


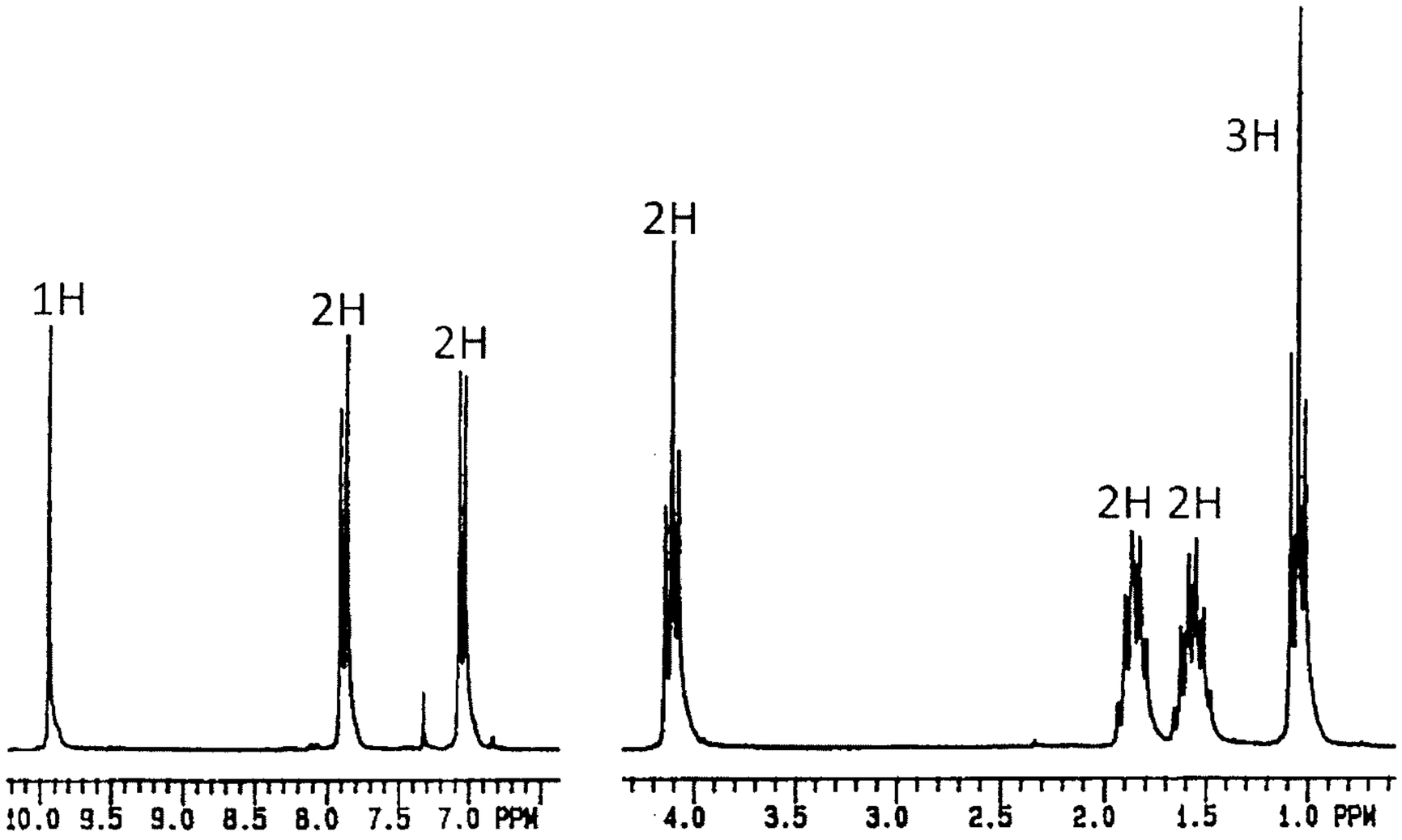
12. Please identify the structure from the spectra. Formula:$C_8H_{14}O_3$ (**6%**)





13. Please identify the structure from the spectra. Formula: $C_{11}H_{14}O_2$ **(6%)**





14. A compound has a m/z value of about 196.0 , and we also know that the elements are C(61.22%)、H(6.16%)、O(32.62%) by elemental analysis. The chemical shift value of NMR spectrum are: (ppm) 3.83 (3H,s), 4.31 (s), 4.80 (s), 6.92 (d), and 6.99(d). Please draw the structure of this compound. (**8%**)