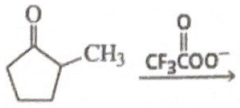
Organic Chemistry (2nd semester)

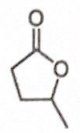
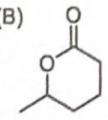
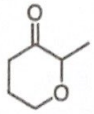
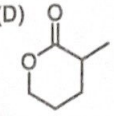
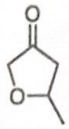
Third term examination (Friday, Mar. 16th, 2025, 8:00 ~ 10:00)

Name: _____ ; Student ID number: _____ ; Score: 204 / 310

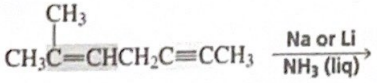
A. Select suitable option of the following question (6 points for each question) 180

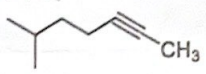
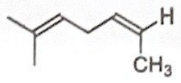
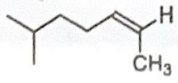
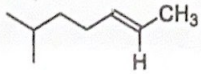
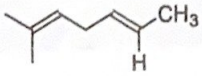
B 1. What is the product structure of the following reaction?



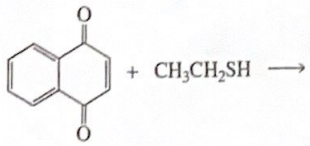
(A)  (B)  (C)  (D)  (E) 

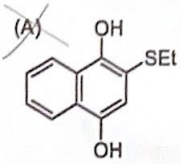
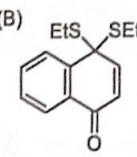
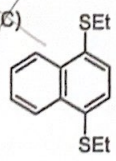
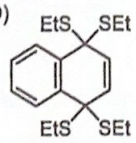
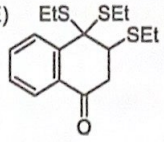
E 2. Which of the following compounds is the expected product?



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

A 3, What is the correct structure of the following reaction?



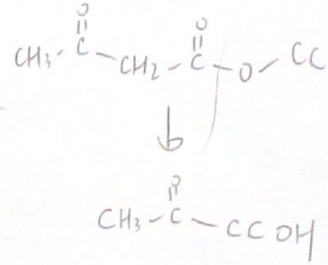
(A)  (B)  (C)  (D)  (E) 

E 4. What sequence of reactions would best accomplish the following conversion?

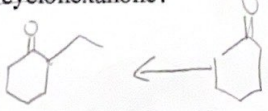
$CH_3C(O)CH_2CO_2Me$ to $CH_3C(O)CH_2CH_2OH$

(A) $NaBH_4/H_3O^+$ (B) H_2/Pt; PCC (C) $KMnO_4/HO^-$; heat

(D) $LiAlH_4/H_3O^+$ (E) $HOCH_2CH_2OH/H^+$; $LiAlH_4$; H^+/H_2O



B 5. Which of the following routes works best for the preparation of 3-ethylcyclohexanone from cyclohexanone?



(A) 1. LDA 2. Br_2 3. CH_3CH_2MgBr

(B) 1. Br_2, H_3O^+ 2. $KOC(CH_3)_3$ 3. $(CH_3CH_2)_2CuLi$ 4. H_3O^+

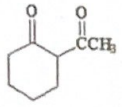
(C) 1. Br_2, H_3O^+ 2. CH_3CH_2OH, Δ

(D) 1. NBS 2. Mg, ether 3. CH_3CHO

(E) 1. Br_2, hυ 2. NaOH 3. $NaOCH_2CH_3$ 4. H_3O^+

D

6. What materials are needed to prepare the following product under NaOMe/MeOH followed by acidic workup?



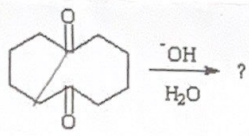
(A) cyclohexenone + $CH_3C(O)H$ (B) cyclohexanone + $CH_3C(O)$ Me

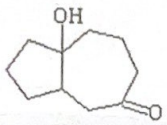
(C) cyclohexanone + $CH_3C(O)H$ (D) cyclohexanone + $CH_3C(O)OCH_3$

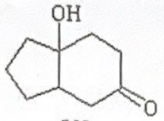
(E) cyclohexenone + $CH_3C(O)OMe$

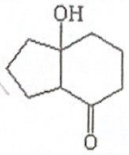
D

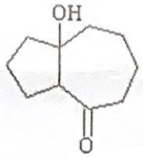
7. What is the major organic product of the following reaction?

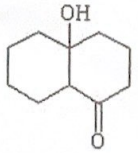


I. 

II. 

III. 

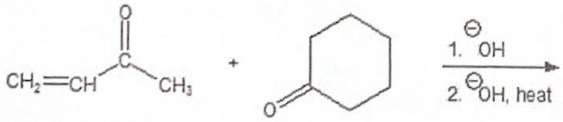
IV. 

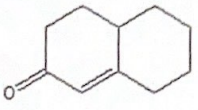
V. 

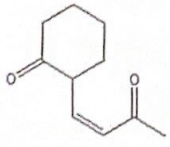
(A) I (B) II (C) III (D) IV (E) V

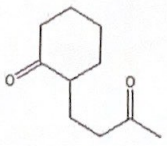
A

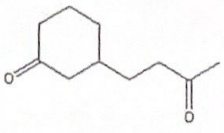
8. Give the major product for the following reaction.



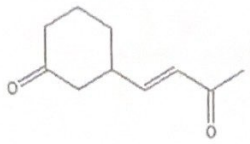
(A) 

(B) 

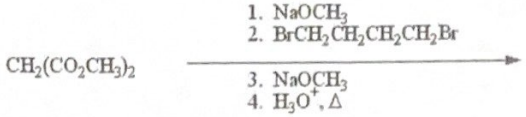
(C) 

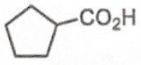
(D) 

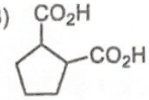
(E)

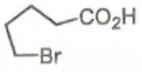


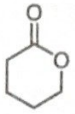
A 9. Provide the major organic product of the following.

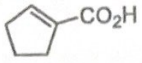


(A) 

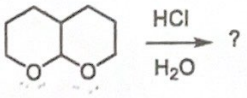
(B) 

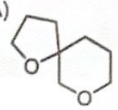
(C) 

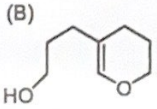
(D) 

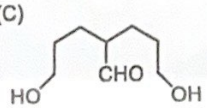
(E) 

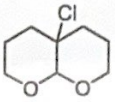
C 10. Which of the following is the expected product for the following reation?

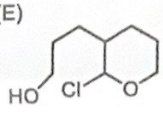


(A) 

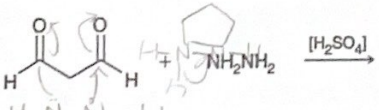
(B) 

(C) 

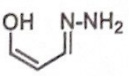
(D) 

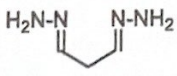
(E) 

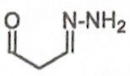
E 11. Which of the following is the expected product for the following reation?



(A) 

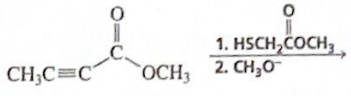
(B) 

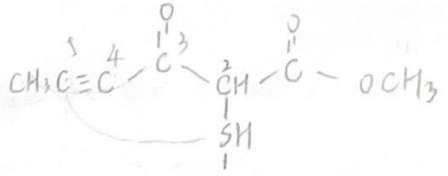
(C) 

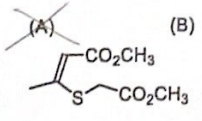
(D) 

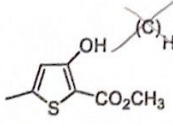
(E) 

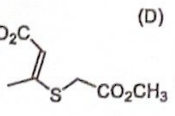
B 12. Which of the following is the expected product for the following reation?
(hint: Michael + Dieckmann)

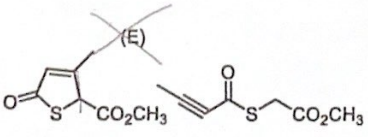


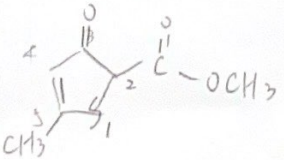


(A) 

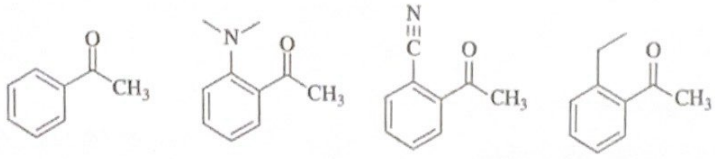
(B) 

(C) 

(D) 



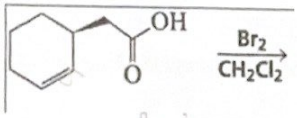
13. Rank the following compounds from the most reactive to the least reactive toward nucleophilic addition.

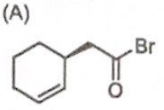


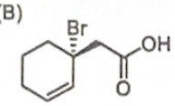
I II III IV

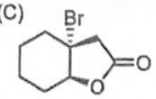
(A) III > I > IV > II (B) III > IV > I > II (C) I > III > II > IV
(D) I > IV > III > II (E) IV > I > III > II

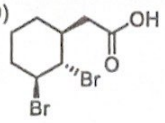
14. Which of the following is the expected product for the following reation?

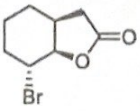


(A) 

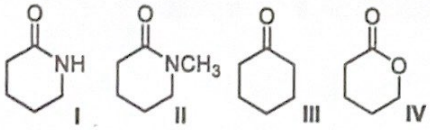
(B) 

(C) 

(D) 

(E) 

15. Rank the compounds in the following group from strongest acid to weakest acid.

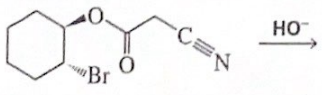


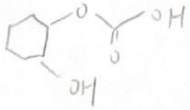
I II III IV

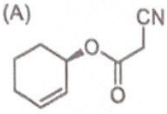
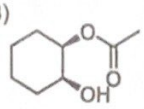
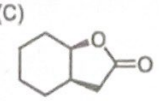
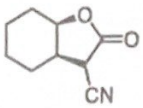
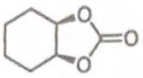
(A) III > I > IV > II (B) III > IV > I > II (C) I > III > IV > II
(D) I > IV > III > II (E) IV > I > III > II

16. Alpha halogenation of a ketone can be accomplished using?
(A) Br_2, acid catalyst (B) Br_2, base catalyst (C) 1. LDA 2. Br_2
(D) NaBr, H_2O, heat (E) all except D

17. Which of the following is the expected product for the following reation?

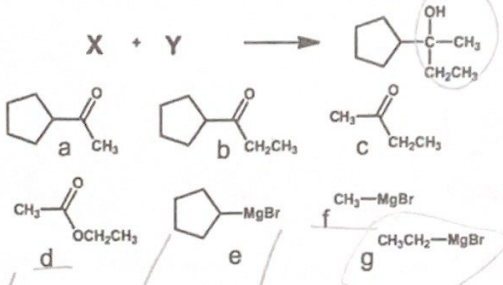




(A)  (B)  (C)  (D)  (E) 

E

18. Which pair of reagents will form the given product?



(A) a + g (B) b + f (C) c + e (D) d + f (E) all except **D**

D

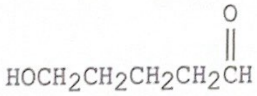
19. Which of the following is the best method for preparing lactic acid from acetaldehyde?

lactic acid acetaldehyde

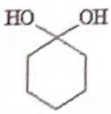
(A) Cl_2; -OH; CH_3OH (B) CH_3MgBr; -OH (C) $KMnO_4$; -OH (D) HC≡N; H_3O^+/heat (E) Cl_2; Mg/ether; -OH

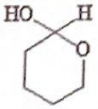
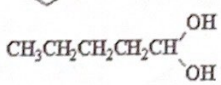
B

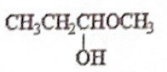
20. The compound shown below can form a hemiacetal by reacting with itself in acidic solution.



What is the structure of this hemiacetal?

I  III 

II  IV. 

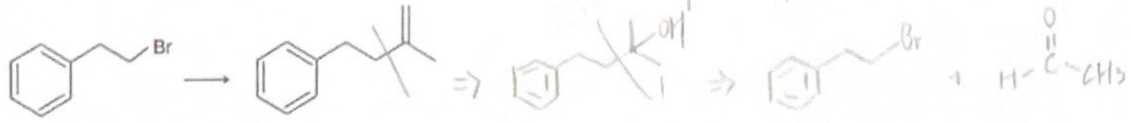
V. 

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

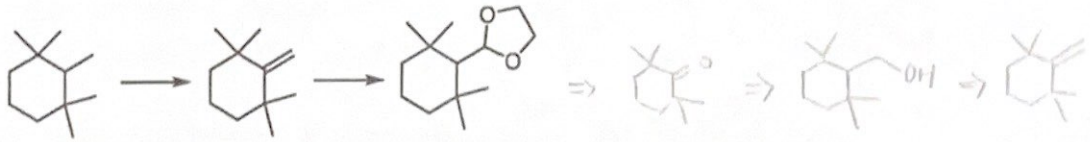
B. Provide suitable reagent for each of the following transformation

(10 points for each question)

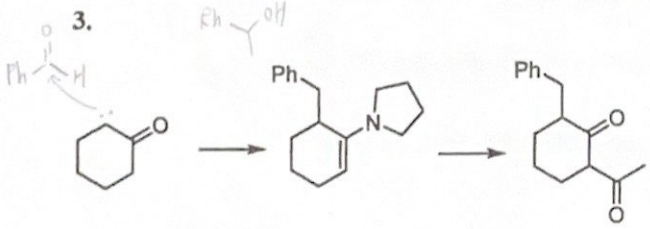
1.



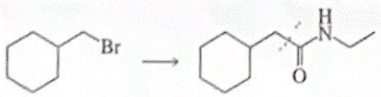
2.



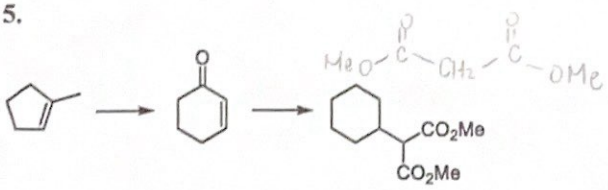
3.



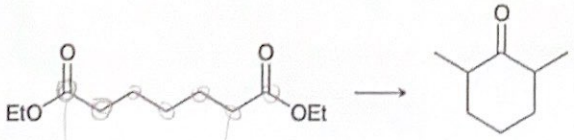
4.



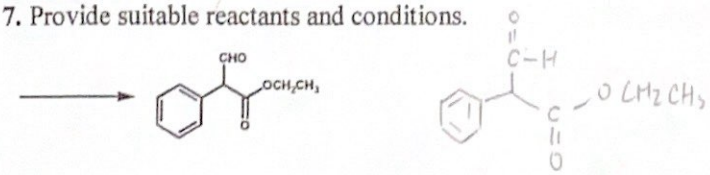
5.



6.



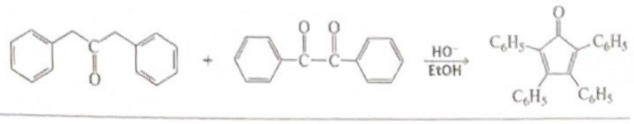
7. Provide suitable reactants and conditions.



C. Propose a mechanism for each of the following transformation

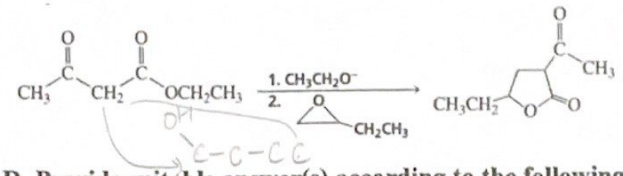
(10 points for each question)

1.



2. Propose a mechanism for the reduction of *N*-methyl-acetamide with $LiAlH_4$.

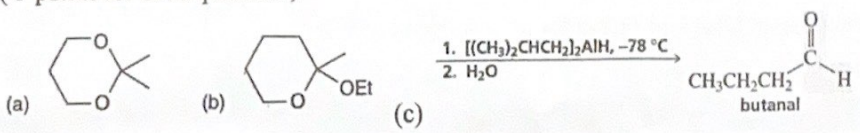
3.



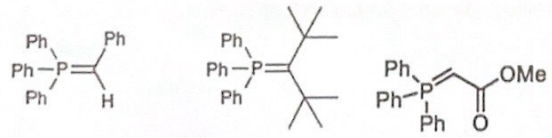
D. Provide suitable answer(s) according to the following questions

1. Identify the starting materials needed to make each of the following compounds

(5 points for each question)

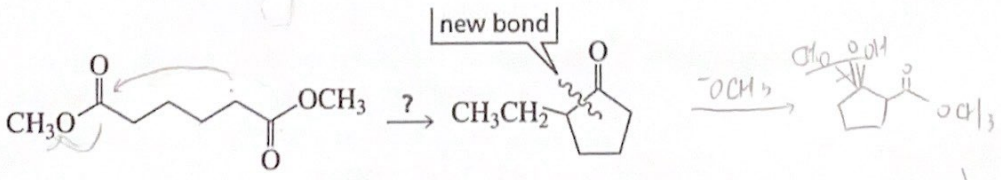


2. Draw the structure of the alkyl halide needed to prepare each of the following Wittig reagents and then determine which Wittig reagent will be the more difficult to prepare. Explain your choice (10 points)

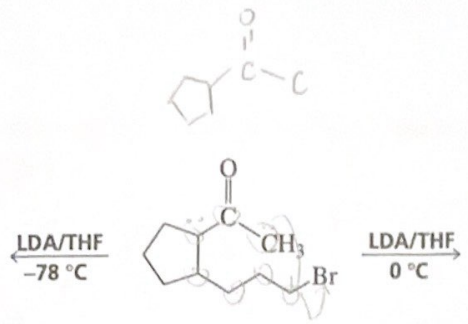


3, Provide a sequence of reactions to achieve the following multi-step synthesis.

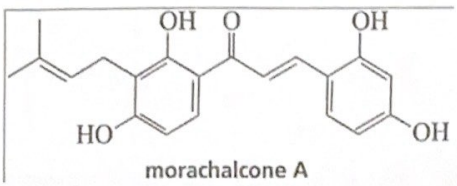
(10 points)



4. Explain why the following bromoketone forms different bicyclic compounds under different reaction conditions (5 points for each of the two products and 5 points for the reasons)



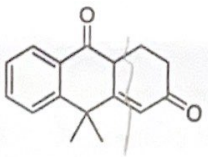
5. Show how you might prepare morachalcone A. (10 points)



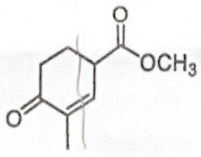
morachalcone A

6. Identify what reagents and reaction conditions you would use to make the following compounds (15 points for each question)

(a)



(b)



7. Identify all of the products formed when the compound below is treated with aqueous acid (10 points)