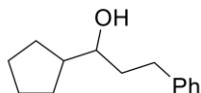


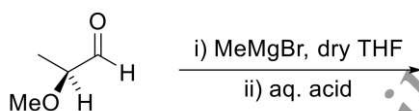
Compilation of CU questions: Organic synthesis and related

2022

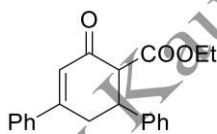
1. How do you protect propane-1,3-diol? Write down the deprotecting agent as well. (1)
2. Give one example of each of the following – i) illogical electrophile, ii) illogical nucleophile. (1)
3. Write down the synthetic equivalents of the following synthons – i) ^-:CHO , ii) Ph^- . (1)
4. Show the retrosynthetic analysis and the forward synthesis of the following TM. (2)



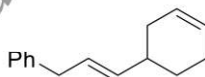
5. Define stereospecific and stereoselective reactions and explain the difference between these two terms using addition of triplet and singlet carbenes to *Z*-2-butene as an example. (2)
6. Using Felkin-Anh model determine the stereochemistry of the major product of the following reaction: (2)



7. Show the retrosynthetic analysis and the forward synthesis of the following TM. (3)

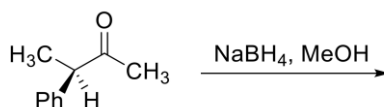


8. Provide possible modes of retrosynthetic analysis and efficient synthesis for the following. Which mode is the better choice? (2)



2021

9. Convert PhCHO to PhCOCH_3 using umpolung strategy. (1)
10. Give one example of each of the following – i) illogical electrophile, ii) illogical nucleophile. (1)
11. Write down the synthetic equivalents of the following synthons – i) ^-COOH , ii) $\text{^+CH}_2\text{CH}_2\text{OH}$. (1)
12. Using Felkin-Anh model to determine the stereochemistry of the major product of the following reaction: (2)

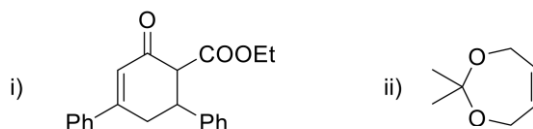


13. Mention two criteria for a good protecting group. Using appropriate protection-deprotection strategy, outline the following transformation. (3)

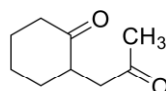


14. Very dilute solution of ω -bromo aliphatic acids in butanone on boiling in the presence of potassium carbonate gives lactones, but a concentrated solution of the same gives polymeric products. Explain. (2)

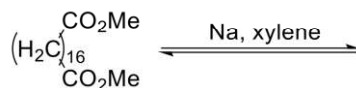
15. Show the retrosynthetic analysis and the forward synthesis of each of the following TMs. (3)



16. Show the retrosynthetic analysis and the forward synthesis of the following TM. (3)



17. Give the product and mechanism of the following reaction. Explain how the addition of Me_3SiCl benefits the formation of the product in the reaction. (3)

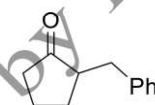


2020

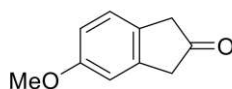
18. Define donor and acceptor synthon with an example for each. (2)

19. With the help of Felkin-Anh model, predict the product when (*R*)-benzoin is reduced with LiAlH_4 . (3)

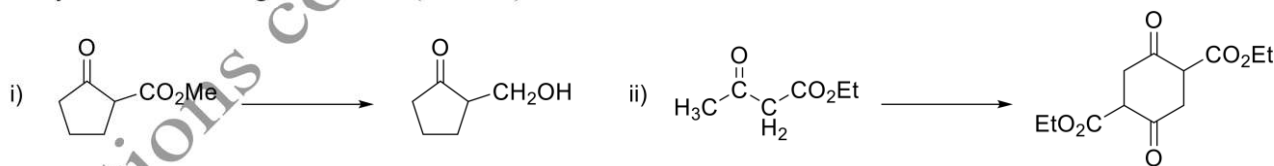
20. Synthesize the following from adipic acid. (2)



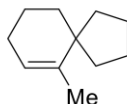
21. Show the retrosynthetic analysis and the forward synthesis of the following TM. (3)



22. Carry out the following conversion: (1.5 each)

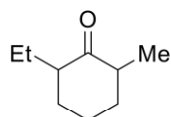


23. Propose a synthesis for the following TM starting from cyclopentanone. (2)

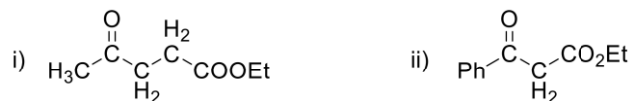


24. Alcohols are often protected by forming OTHP derivatives. What advantages does it provide? Mention the protection and deprotection techniques. (2)

25. Synthesize the following from cyclohexanone. (2)



26. How can you make the following compounds from ethyl acetoacetate? (3)

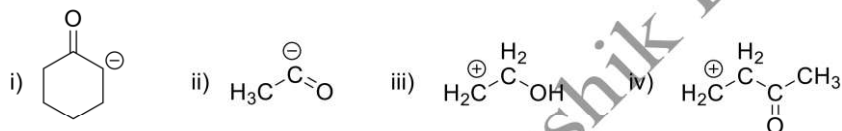


2019

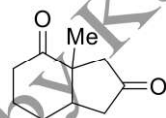
27. How can you make the following compounds from ethyl acetoacetate? (3)



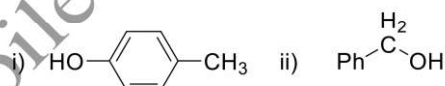
28. Write down the synthetic equivalents of the following synthons: (2)



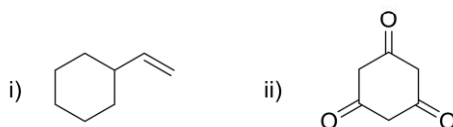
29. Show the retrosynthetic analysis and the forward synthesis of the following TM. (3)



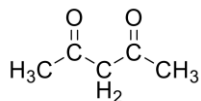
30. Show the reagents for protection and deprotection of the following compounds: (3)



31. Show the retrosynthetic analysis and the forward synthesis of each of the following TMs. (2+3)



32. Using illogical synthon, carry out the synthesis of the following TM. (2)

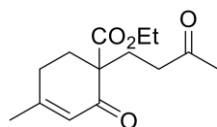


33. Synthesise – i) 2,5-dimethylcyclohexanone from cyclohexanone, ii) the following TM from diethylmalonate. (3)

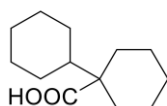


2018

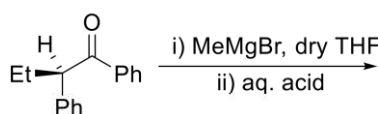
34. Suggest a synthesis of the following diketo ester starting from ethyl acetoacetate as one of the synthetic precursors. (3)



35. Synthesise the following compound using Favorskii rearrangement. (2)



36. Using Felkin-Anh model determine the stereochemistry of the major product of the following reaction: (2)



37. Propargyl bromide is an illogical electrophile. Explain with a suitable example. (2)

38. Show the retrosynthetic analysis and the forward synthesis from easily available starting materials for each of the following TMs. (3)

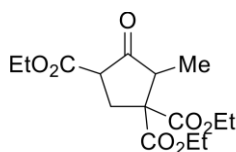


39. How are 1,2- and 1,3-diols protected during a synthesis? Show the deprotection procedure as well. (2)

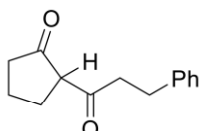
40. Show the syntheses of each the following compounds showing retrosynthetic analysis. (3)



41. Show how the following compound can be synthesised starting from diethyl malonate. (2)



42. Suggest a way to converting 2-acetylcyclopentanone to the following: (2)

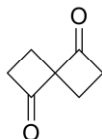


2017

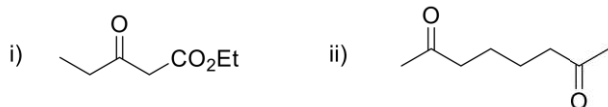
43. Show the retrosynthetic analysis and the forward synthesis for each of the following TMs. (3)



44. Outline the synthesis of the following compound from diethylmalonate. (2)



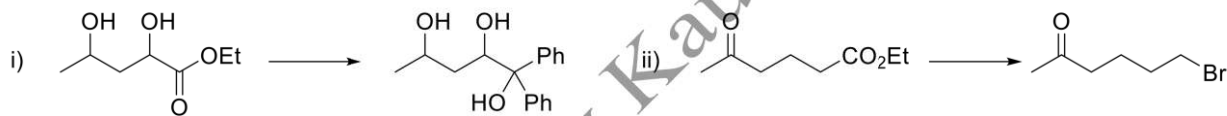
45. How can you make the following compounds from ethyl acetoacetate? (3)



46. Justify the statement that “all stereospecific reactions are stereoselective but all stereoselective reactions are not necessarily stereospecific”. Give proper examples. (3)

47. The alcohol functional group is often protected by making its *t*-butyl ether as ROH to ROCMe₃. What advantages does this *t*-butyl group provide? Mention the protection and deprotection technique. (2)

48. Using the protection-deprotection techniques, outline the following transformations: (3)



49. Illustrate the use of acyloin condensation for the synthesis of large rings. Discuss the role of TMSCl which can be used to improve the yield. (3)

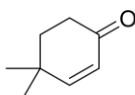
50. Describe the synthesis of each of the following TMs with proper retrosynthetic analysis. (2 each)



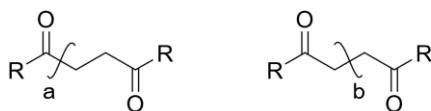
2016

51. Enamine of 2-methylcyclohexanone on treatment with methyl iodide followed by hydrolysis furnishes 2,6-dimethylcyclohexanone only. Explain. (2)

52. Trace the pathway of formation of 4,4-dimethyl-2-cyclohexenone from methyl vinyl ketone and Me₂CHCHO. (3)

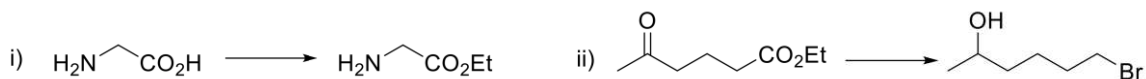


53. Two possible disconnections (a and b) for the TM is shown below. Obtain a pair of suitable synthons from each disconnection and indicate the umpolung synthon, if any. Give synthetic equivalent for each synthon. (3)



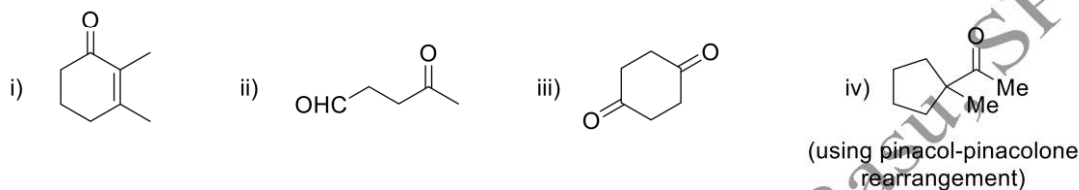
54. Using umpolung synthesis, show the retrosynthetic analysis of cyclobutanone from formaldehyde and 1,3-dihalopropane. (2)

55. Using protecting group strategy how would you bring about the following transformations? (3)

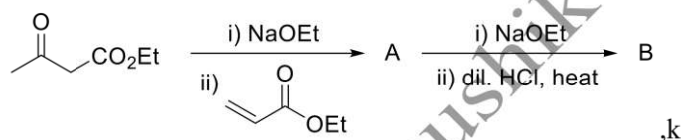


56. Draw the Felkin-Anh models for (*S*)-benzoin and show the reaction with CH_3MgI and give the preferred stereochemistry of the major product formed. (2)

57. Give retrosynthetic analysis and carry out the synthesis for each of the following TMs: (3 for i), 1.5 for ii) and iii) each, 2 for iv))

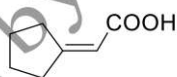


58. Identify X and Y in the following sequence of reactions. (3)



2015

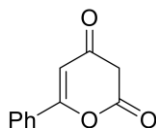
59. Show the retrosynthetic analysis and carry out the syntheses for the following TMs. (3)



60. Provide the synthetic equivalents for the following: (2)



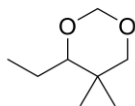
61. Propose a synthetic route for the following TM taking EAA and benzoyl chloride as possible synthetic equivalents produced after retrosynthesis. (3)



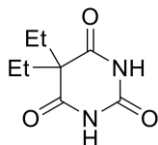
62. Carry out the following conversions using protection-deprotection strategy: (3)



63. Propose a synthetic route for the following TM. (2)



64. How can the following TM be made from diethyl malonate? (2)

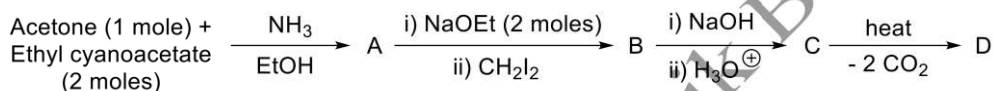


65. Explain with proper examples, donor and acceptor synthons. (2)

66. Discuss how Zeigler applied high-dilution technique to improve the yield by alicyclic ring compounds. Give an example. (2)

2014

67. Identify A to D in the following sequence of reactions. (3)

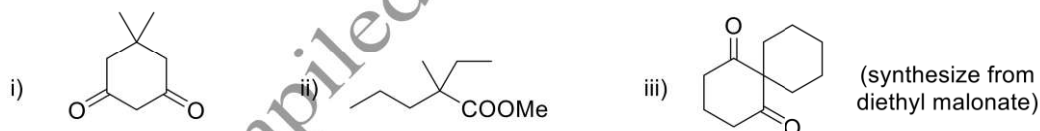


68. Provide suitable synthetic equivalents for the following synthons: (2)

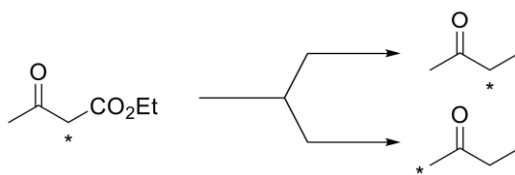


69. Justify the statement that “all stereospecific reactions are stereoselective but all stereoselective reactions are not necessarily stereospecific”. (2)

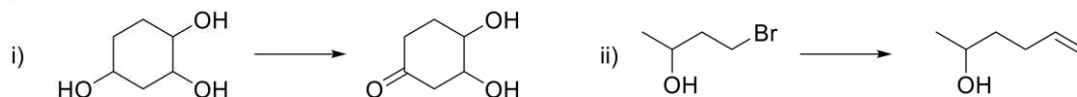
70. Show the retrosynthetic analysis for each of the following TMs and show the respective forward syntheses. (3)



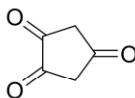
71. How can the following TMs be made from the precursor shown? (2)



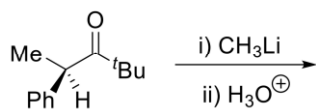
72. Using protecting groups to transform: (3)



73. How would you prepare the following molecule using Claisen ester condensation reaction. (2)



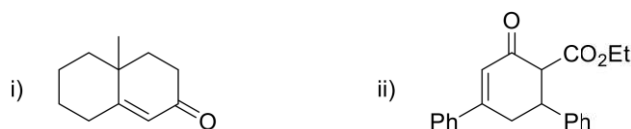
74. Using Felkin-Anh model explain the formation of the major product in the following reaction: (3)



75. Very dilute solution of ω -bromo aliphatic acids in butanone on boiling in the presence of potassium carbonate gives lactones, but a concentrated solution of the same gives polymeric products. Explain. (2)

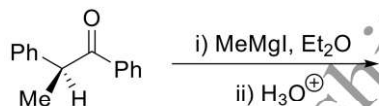
2013

76. Show the retrosynthetic analysis for each of the following TMs and carry out the synthesis. (3)



77. Explain the following terms with proper examples – synthon and umpolung. (2)

78. Using Felkin-Anh model explain the formation of the major product in the following reaction: (3)



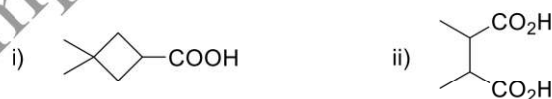
79. Outline the synthesis of the following TM from ethyl acetoacetate. (2)



80. Define diastereoselectivity and enantioselectivity with suitable examples.

81. Discuss how Zeigler applied high-dilution technique to improve the yield by alicyclic ring compounds. Give an example. (3)

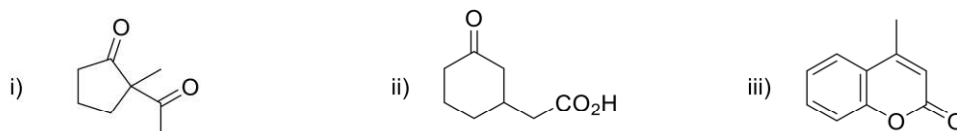
82. How would the following TM be made from diethyl malonate? (3)



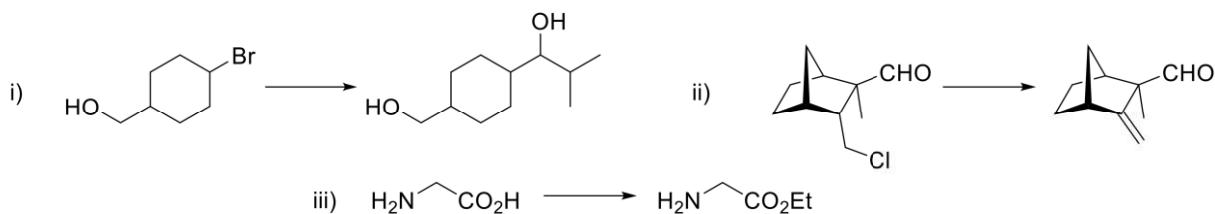
2012

83. Explain the terms synthetic equivalent and functional group addition, giving example in each case. (3)

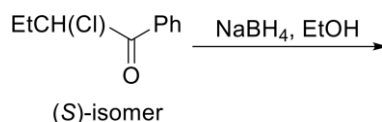
84. Show the retrosynthetic analysis and an efficient synthesis for each of the following TMs. (2.5 each)



85. Mention two criteria for a good protecting group. Using the protection-deprotection strategy, outline the following transformations: (1 + 2x3)



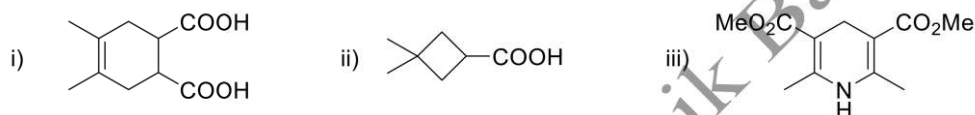
86. Predict the major product of the following reaction and justify. (2)



2011

87. What is meant by – i) illogical electrophile, ii) illogical nucleophile? Give example in each case. (2)

88. Show the retrosynthetic analysis and an efficient synthesis for each of the following TMs. (2.5 each)



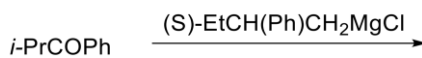
89. Two possible disconnections (a and b) for the TM is shown below. Obtain a pair of suitable synthons from each disconnection and indicate the umpolung synthon, if any. Give synthetic equivalent for each synthon. (3)



90. How can you convert EAA into the following two TMs? (3)

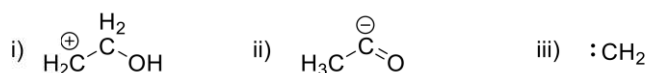


91. Predict, with reasons, the major product of the following reaction. Is the reaction enantioselective or diastereoselective? (3)

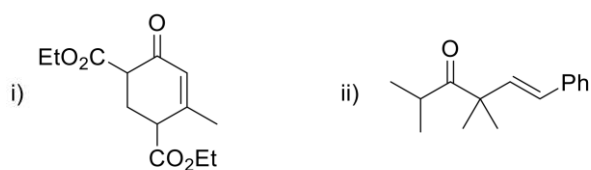


2010

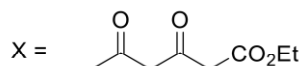
92. What do you mean by electrophilic and nucleophilic synthons? Suggest the synthetic equivalents of: (1+3)



93. Show the retrosynthetic analysis and an efficient synthesis for each of the following TMs. (3 each)



94. How can you convert – i) cyclohexanone to 2,6-dimethylcyclohexanone, ii) EAA to X? (1.5 each)



95. Using a suitable protecting group, convert EAA to 3-oxobutan-1-ol. (2)

96. Show the pattern of latent polarities of an 1,4-dioxygenated and an 1,5-dioxygenated functions, and hence discuss their suitable disconnections in terms of retrosynthetic analysis. (3)

97. Predict the major product of the following reaction. State the rule that you would use for your prediction. (2)

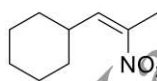


2009

98. Show the retrosynthetic analysis and an efficient synthesis for each of the following TMs. (2.5 each)



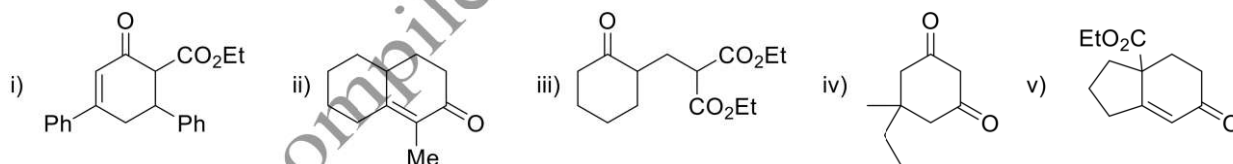
99. Starting with simple acyclic compounds, show how you would prepare the following TM. Give the retrosynthetic analysis in favour of your pursuance. (2.5)



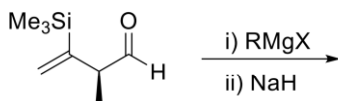
100. Write the rationale behind the success of the high dilution technique in synthesis of large ring compounds. Explain your answer with a suitable example. (2.5)

2008

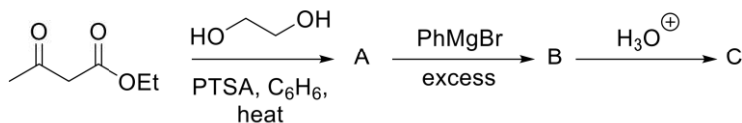
101. Show the retrosynthetic analysis and an efficient synthesis for each of the following TMs. (2.5 each)



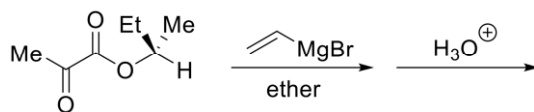
102. Write down the structure including the stereochemistry of the intermediate and the final product of the following reaction. (2)



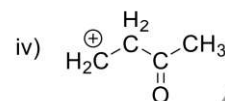
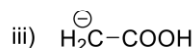
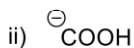
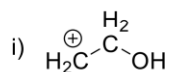
103. Identify A, B and C of the following reaction. (2)



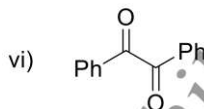
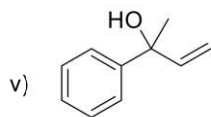
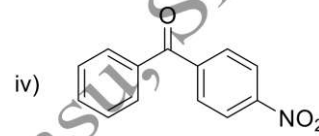
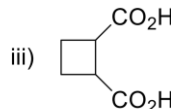
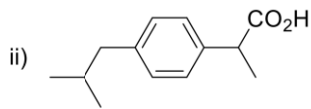
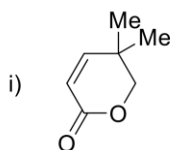
104. Predict the major product of the following reaction and justify your answer. (2)



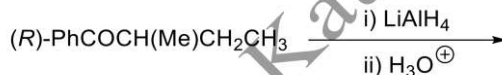
105. Suggest a synthetic equivalent for each of the following synthons: (1 each)



106. Show the retrosynthetic analysis and an efficient synthesis for each of the following TMs. (2 each)

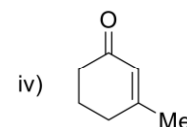
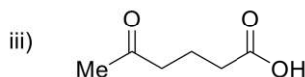
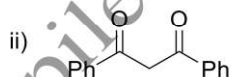
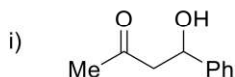


107. What is the major stereoisomeric product of the reaction? How can you synthesize the other diastereoisomer of the product of the following reaction? (3)

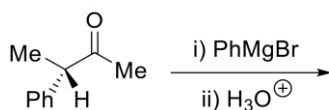


2007

108. Show the retrosynthetic analysis and an efficient synthesis for each of the following TMs. (2.5 each)

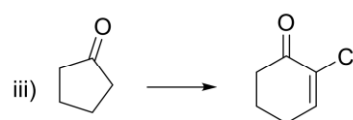
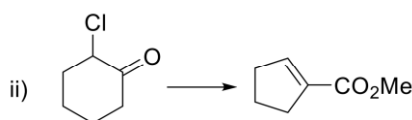


109. Predict the major product of the following reaction and justify your answer. (2)



110. In protecting an aldehyde to a thioacetal, there is inversion of polarity at the carbonyl carbon but no such effect is observed in case of the oxyacetal of the aldehyde. Explain. (2)

111. Outline the following transformations: (2 each)



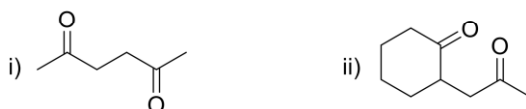
112. Show how you may use a cyclic acetal to carry out the following transformation:



2006

113. How can you convert $\text{BrCH}_2\text{CH}_2\text{CHO}$ to $\text{Et-C}\equiv\text{C-CH}_2\text{CH}_2\text{CHO}$? (2)

114. Write the retrosynthesis of the each of the following TMs in two different ways. Give one synthetic method for preparation of the both TMs. What happens when the two compounds are separately heated with ethanolic alkali? $(1+1+1+1) \times 2$



115. Mention two criteria for a good protecting group. Using protection-deprotection strategy, outline how one can achieve the following transformation. (1+2)

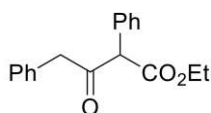


2005

116. Reduction of 2-heptanone with (*R*)-butan-2-ol in presence of Al 2-butoxide gives (*R*)-3-heptanol. Explain with mechanism. (2)

117. Explain the terms synthetic equivalent and functional group interconversion with suitable examples in each case. (3)

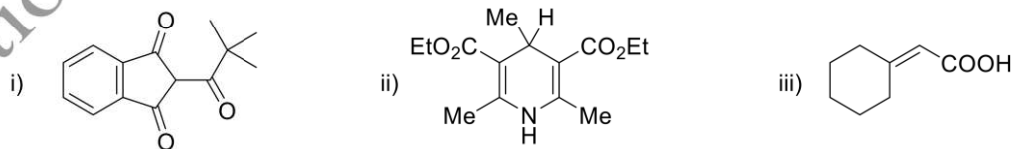
118. Discuss two different retrosynthetic pathways for the following TM. Which pathway will lead to a more efficient synthesis of the TM and why? (4)



2004

119. Explain, with proper examples, the terms umpolung, illogical electrophile and illogical nucleophile. (3)

120. Show the retrosynthetic analysis and an efficient synthesis for each of the following TMs. (2 each)

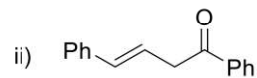
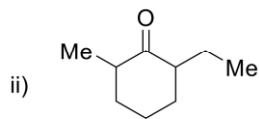
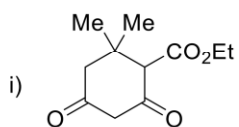


121. Describe a suitable synthesis where benzaldehyde may be utilized as an acyl anion equivalent. (2)

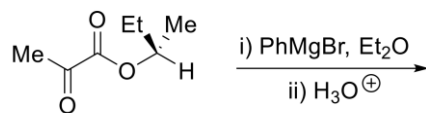
2003

122. Explain, with proper examples, the terms synthon and functional group interconversion. (2)

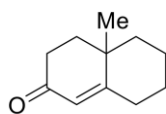
123. Show the retrosynthetic analysis and an efficient synthesis for each of the following TMs. (2.5 each)



124. Predict the major product of the following reaction and justify. (3)



125. Trace a possible retrosynthetic pathway for the synthesis of the following compound: (2)



Questions compiled by Kaushik Basu, SPCMC