Birla Institute of Technology and Science, Pilani, Rajasthan-333031

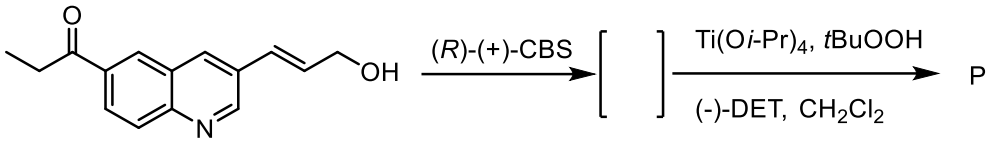
I Semester 2023-24 **Adv. Org. Chem. (CHEM G551)** **Marks 30**

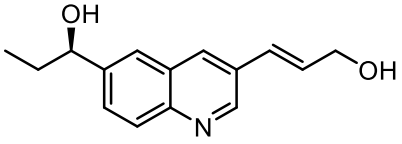
Comprehensive Exam (Close book) **Time: 1 hr (Room No. 1205)** **December 18, 2023**

NAME: .....ID No:.....

Note: There are total **20** questions. Indicate the most appropriate answer by entering **A, B, C, or D** in the box provided. **Do not overwrite. Do not use a pencil. Each correct answer will be awarded a 1.5 mark, and a 0.5 mark will be deducted for every wrong answer.**

Q1. Assign the most suitable product for the given transformation. D



(A)


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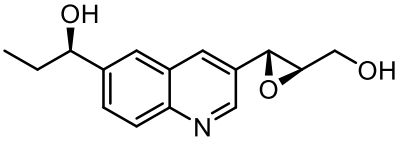

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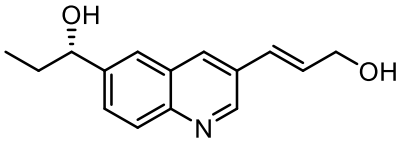

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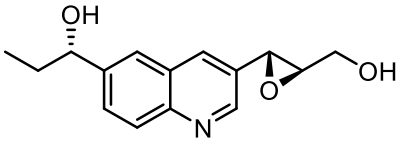
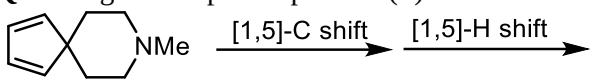
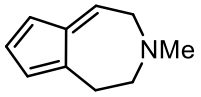


Q2. The number of nodes in the LUMO of 1,3,5-hexatriene is; C

(A) 1 (B) 2 (C) 3 (D) 4

Q3. Assign the expected product (P) of the following transformation. B



(A)


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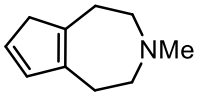

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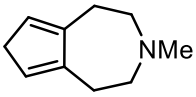

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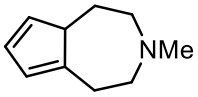
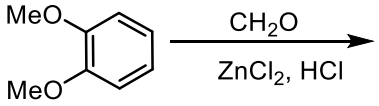
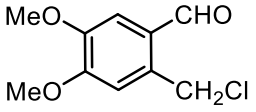


Q4. Assign the expected product for the following transformation. C



(A)


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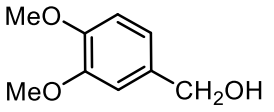

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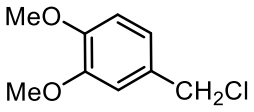

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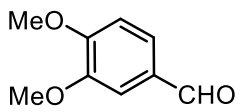
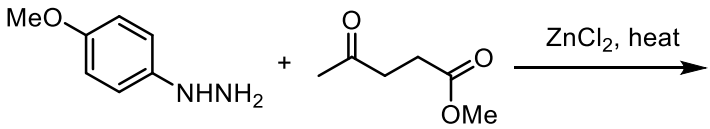
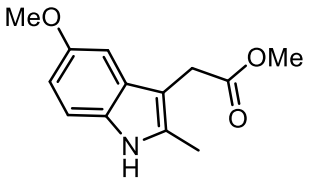


Q5. Assign the most suitable product for the given transformation. A



(A)


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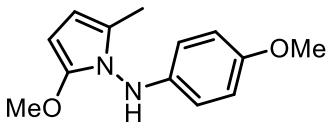

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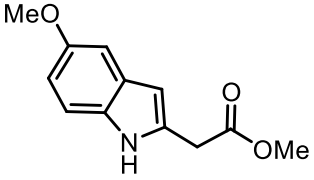

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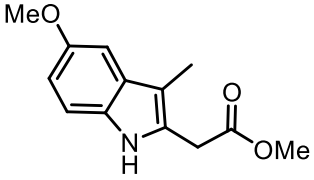
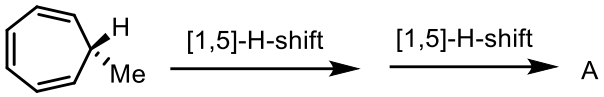
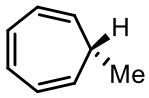
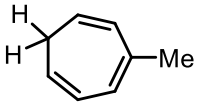


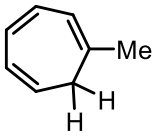
Q6. Predict the structure of the final product A.

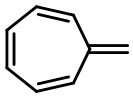


C

(A) 

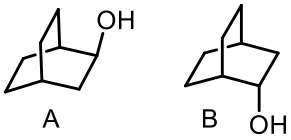
(B) 

(C) 

(D) 

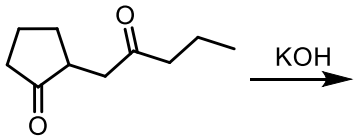
Q7. The relationship between given molecules A and B is……!

C

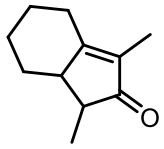


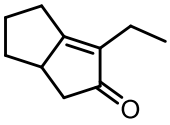
(A) No relation (B) Enantiomers (C) Same molecule (D) Diastereomers

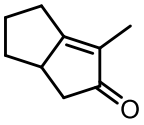
Q8. Assign the expected structure of the product for the following reaction.

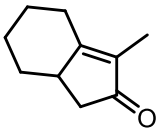


B

(A) 

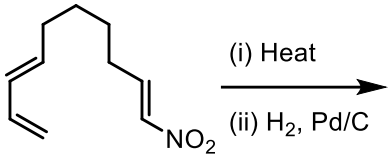
(B) 

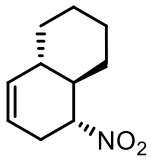
(C) 

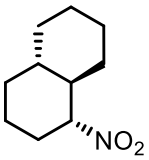
(D) 

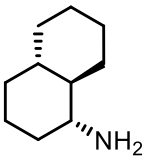
Q9. Identify the major product for the following reaction.

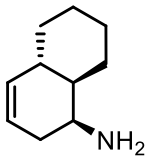
C



(A) 

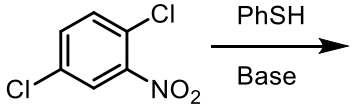
(B) 

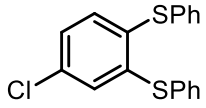
(C) 

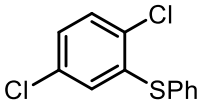
(D) 

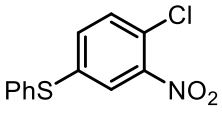
Q10. Which one is the major product for the following transformation?

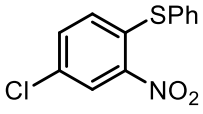
D



(A) 

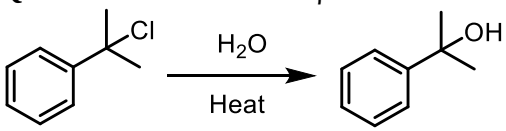
(B) 

(C) 

(D) 

Q11. Predict the Hammett ρ value for the following S_N1 reaction.

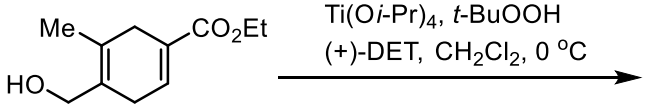
B

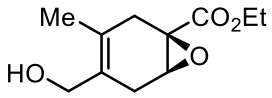


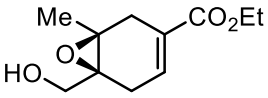
(A) - 0.5 (B) - 4.5 (C) + 1.0 (D) + 5.5

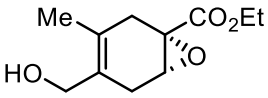
Q12. Predict the structure of the correct product for the given transformation.

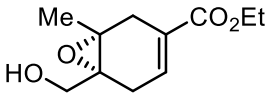
B



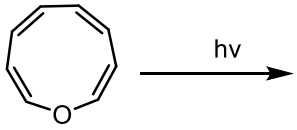
(A) 

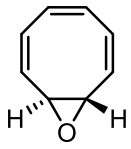
(B) 

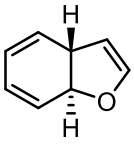
(C) 

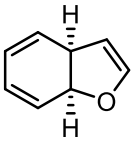
(D) 

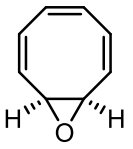
Q13. Assign the most expected product for the following transformation. D



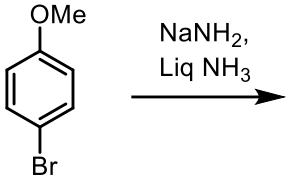
(A) 

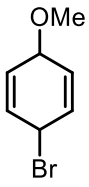
(B) 

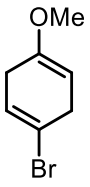
(C) 

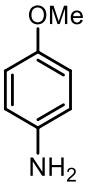
(D) 

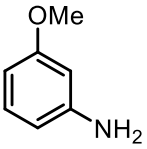
Q14. Assign the suitable product for the given transformation. D



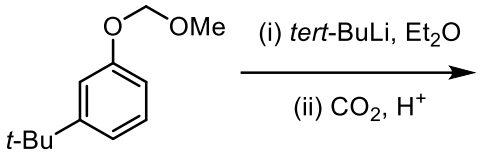
(A) 

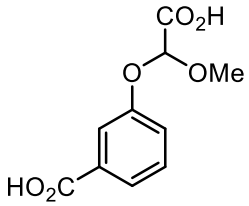
(B) 

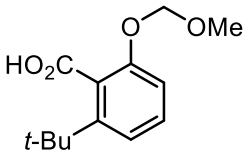
(C) 

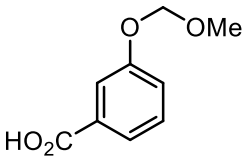
(D) 

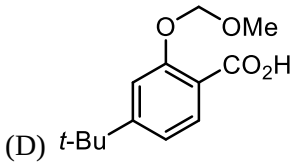
Q15. Predict the correct structure of the correct product for the given transformation. D



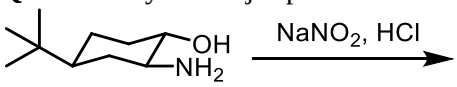
(A) 

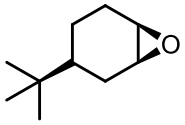
(B) 

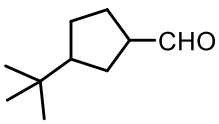
(C) 

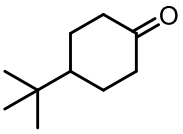
(D) 

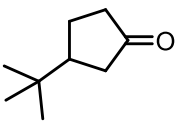
Q16. Identify the major product for the following reaction. B



(A) 

(B) 

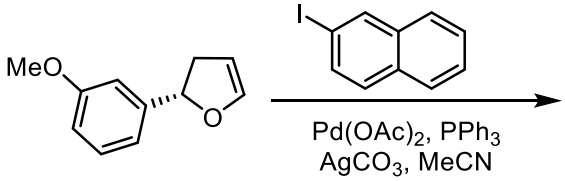
(C) 

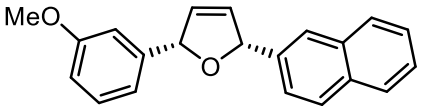
(D) 

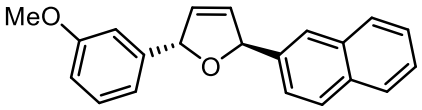
Q17. The energy difference ($\Delta G^{\#}$) between the two enantiotropic transition states to achieve 100% ee will be; D

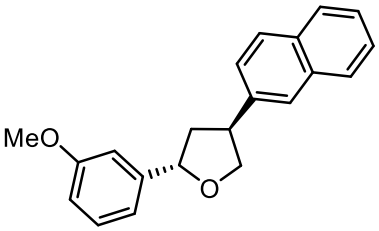
(A) 0 kcal/mol (B) 100 kcal/mol (C) 200 kcal/mol (D) ∞ kcal/mol

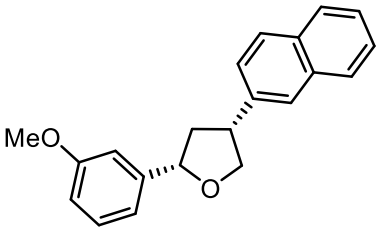
Q18. Predict the correct structure of the product for the given transformation. B



(A) 

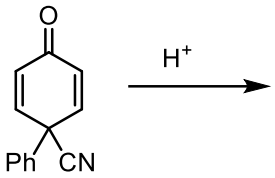
(B) 

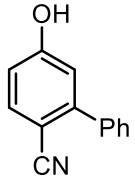
(C) 

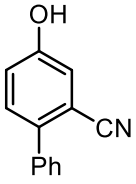
(D) 

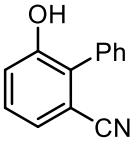
Q19. Predict the correct structure of the product for the given transformation.

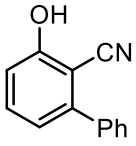
B



(A) 

(B) 

(C) 

(D) 

Q20. If a compound has 87% ee, what will be the enantiomeric ratio (e.r.)?

(A) 87: 13 (B) 93.5: 6.5 (C) 94.5: 5.5 (D) 92.5: 7.5

B

Birla Institute of Technology and Science, Pilani, Rajasthan-333031

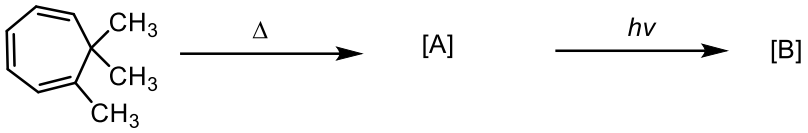
I Semester 2022-23 **Adv. Org. Chem. (CHEM G551)** **Marks 50**

Comprehensive Exam (OPEN BOOK) **Time: 2 hr (Room No. 1205)** **December 18, 2023**

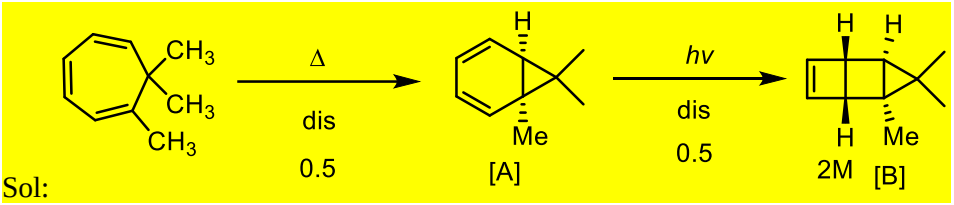
NAME: .....ID No:.....

NOTE: Attempt to answer all parts of a question together.

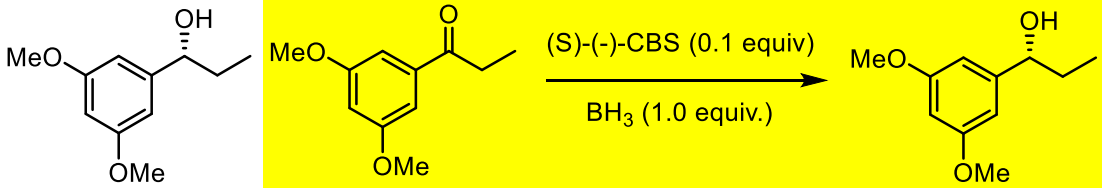
Q1. (a) Rationalizing the structure of **A** and **B** with correct stereochemistry. Label any pericyclic processes during this transformation. [5]



Sol:



(b) Propose a catalytic enantiomeric synthesis of given compound from the corresponding ketone. [3]



(c) Calculate a chiral compound's enantiomeric ratio (er) with an observed rotation of -97.5°. (Given: rotation of enantiomerically pure = –105°). [2]

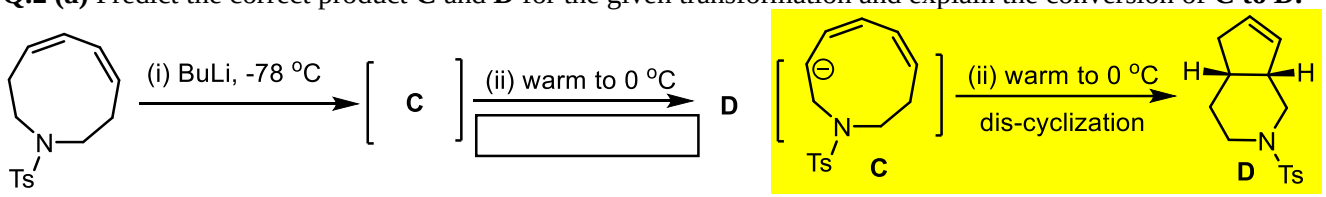
Sol:

$$\text{enantiomeric excess (ee)} = \frac{\text{observed roration}}{\text{rotation of pure enantiomer}} \times 100$$

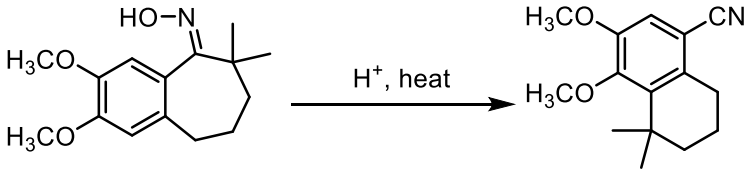
$$= \frac{-97.5}{-105} \times 100 = 92.86 \sim 93\ \%$$

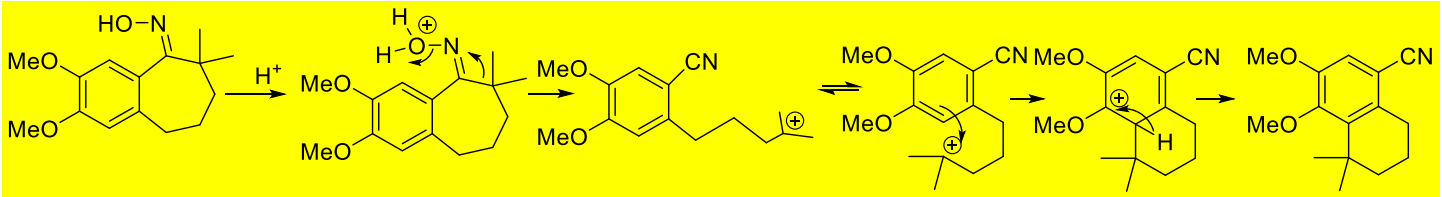
therefore 93% ee = 96.5: 3.5 er

Q.2 (a) Predict the correct product **C** and **D** for the given transformation and explain the conversion of **C to D.** [5]

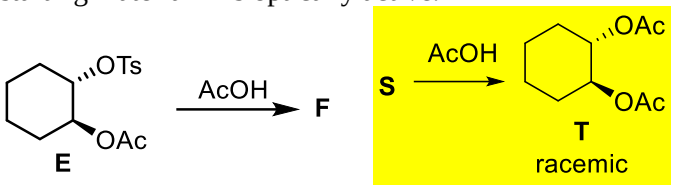


(b) Write the stepwise mechanism for the given transformation. [3]

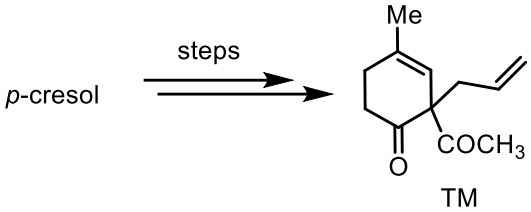


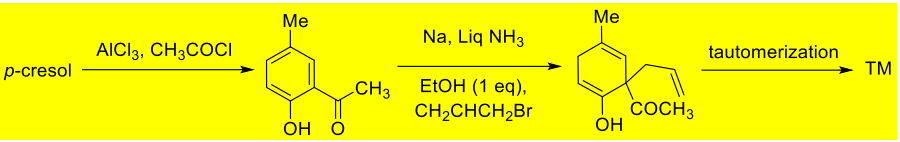


(c) Write the structure of product **F** for the given transformation and comment on the optical activity of the product if starting material **E** is optically active. [2]

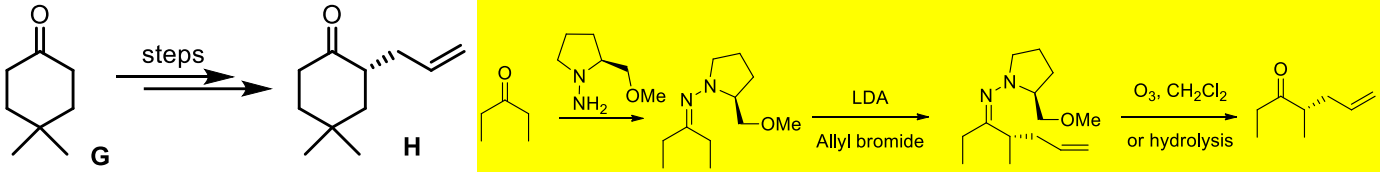


Q3. (a) Propose synthetic steps with reagent and conditions for TM from p-cresol (SM). [4]

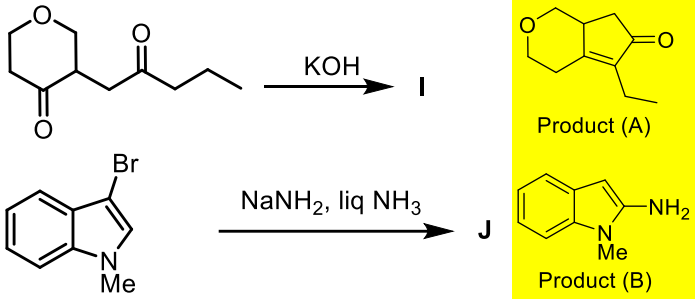




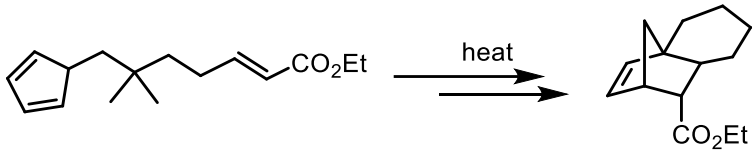
(b) Write all synthetic steps for the asymmetric synthesis of **H** from **G** using the chiral auxiliary approach. (Choose auxiliary and other reactants yourself).
[3]



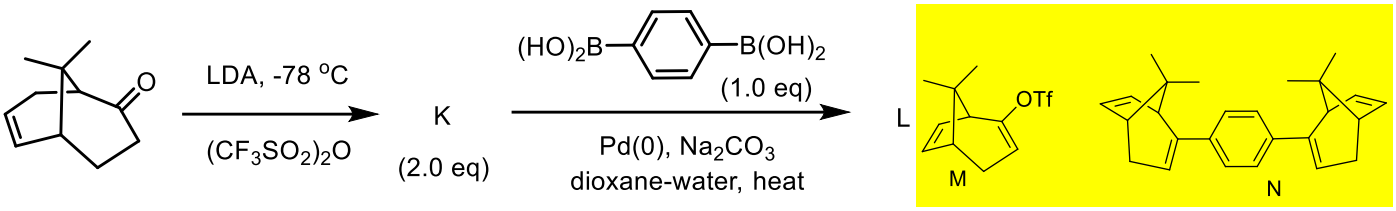
(c) Write the structure of products (**I** and **J**) formed for the given transformations. [3]



Q4. (a) Write the steps for the following conversion while mentioning the reaction sequence. [4]

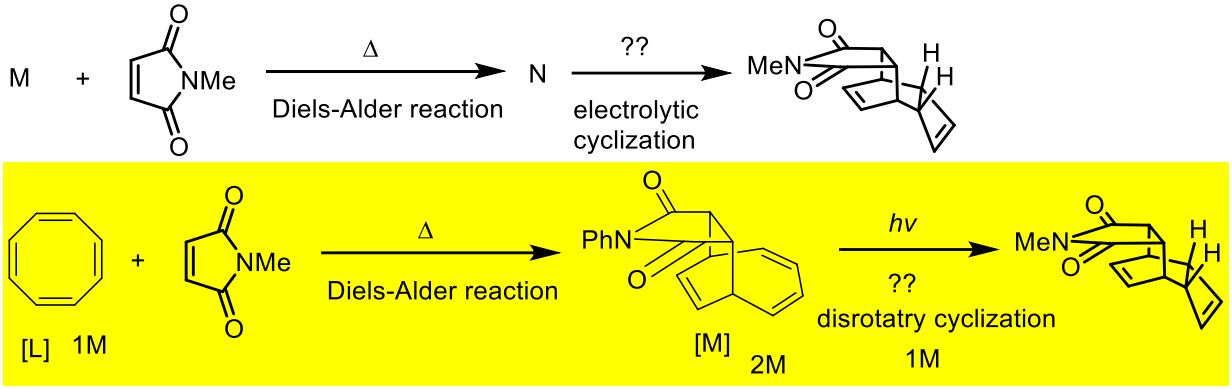


(b) Complete the following reaction by writing the structure of the products **K** and **L**? [2+2]

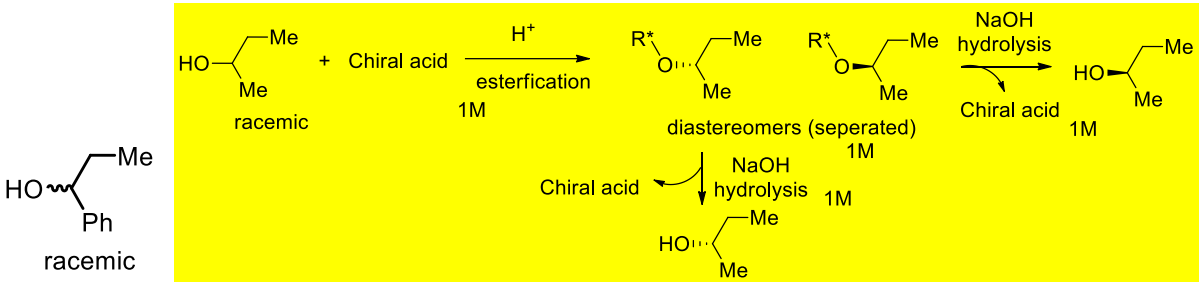


(c) Draw the mechanistic steps transition state model to justify forming a stable *trans*-coupling product for the Heck-coupling reaction.
[2]

Q5. (a) Predict structures of **M** and **N** for the given transformations. Three-dimensional drawings are recommended. State the reaction conditions and mode of pericyclic reaction in the second step. [1+2+1]



(b) Propose the resolution of the given compound by the method of your choice. [3]



(c) Write the structure of product **O** and explain its formation through a stepwise reaction mechanism. [2+1]