

B. Sc. Part-III (Honours) Examination, 2020**SET-2****Subject: Chemistry****Paper: X****(New Syllabus)****Time: 2 Hours****Full Marks: 50**

*The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words
as far as practicable.*

Group-A

1. Answer *any three* questions from the following: **3 × 5 = 15**

(a) Outline the synthetic route for the following compounds.

(I) Malachite green (II) Sulphanilamide

(b) L-threonine has two asymmetric carbons and has the (2S, 3R) configuration. Draw a Fischer projection of L-threonine. Show how the Gabriel malonic ester synthesis could be used to make DL-methionine?

(c) How would you differentiate between geraniol and nerol? Ephedrine and ψ -ephedrine have *erythro* and *threo* configuration, respectively. – Justify your answer.

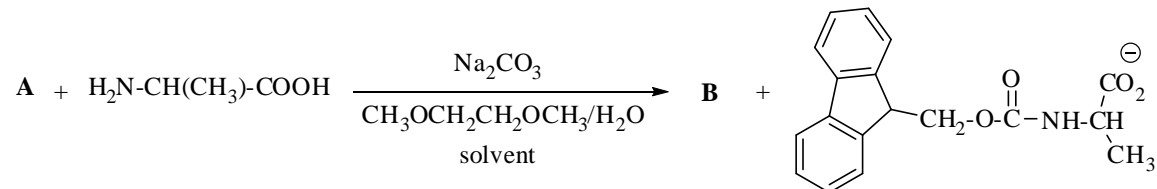
(d) What happens when 3-methylaniline reacts with glycerol in the presence of concentrated sulfuric acid in nitrobenzene solvent? Explain your answer. How would you detect the presence of thiophene in commercial benzene?

(e) Draw the structure of an aldonic acid which you expect to obtain from L-threose. Show the reaction of methyl- α -D-glucopyranoside with acetic anhydride in the presence of pyridine. How many ketotetroses are possible? Write down the Fischer projection formulas of each.

2. Answer *any one* question from the following: **1 × 10 = 10**

(a) Synthesize alanylglycine methyl ester using DCC.

Provide structures of compounds **A** and **B** in the following reaction.



Explain why two monomethyl esters of N-acetyl-L-aspartic acid are known. Draw their structures.

(b) Discuss the structure determination of (+)-Coniine and then show how it can be prepared in laboratory.

Compare the basicities of pyrrole and pyridine. Draw the structure of major organic product formed from the reaction of furfural with Ac_2O in the presence of NaOAc .

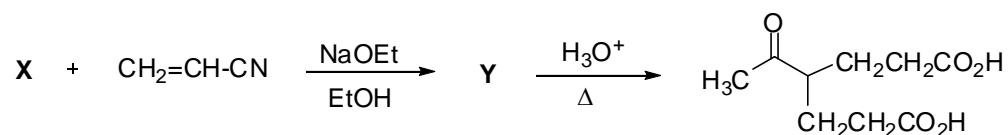
Convert: D-Mannose \rightarrow D-Fructose

Group-B

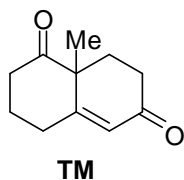
3. Answer *any three* questions from the following:

3 \times 5 = 15

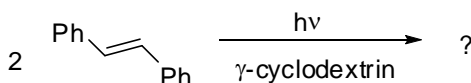
(a) Provide the structures of **X** and **Y** in the following reaction sequence:



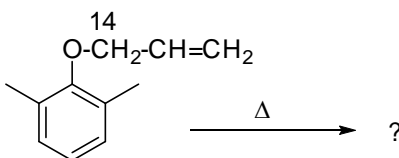
Synthesize the following target molecule (**TM**) by using Robinson annulation reaction.



(b) Predict the product in the following reaction and also mention the frontier molecular orbitals which are involved in the reaction.

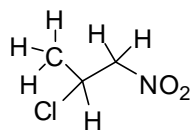


What product would be obtained in the following reaction? Give the reaction mechanism.



(c) How many signals do you expect for the following molecule in its $^1\text{H-NMR}$ spectrum?

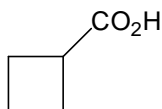
Justify your answer.



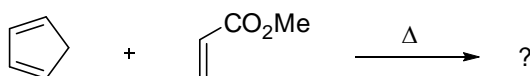
Define 'chromophore' and 'auxochrome' with examples. How would you differentiate the following pair of molecules using infrared spectroscopy?



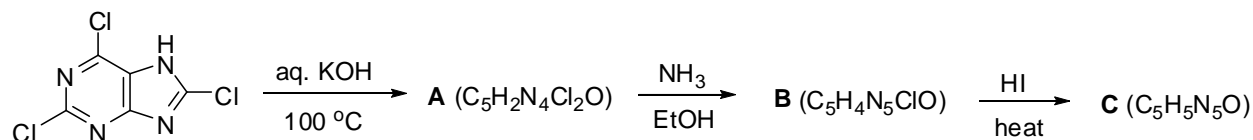
(d) Show the retrosynthetic analysis and then synthesize the following molecule. You are advised to take diethylmalonate as one of the starting materials.



Draw the structure of major product formed in the following reaction and explain your choice.



(e) Identify the products **A** to **C** in the following reaction sequence.

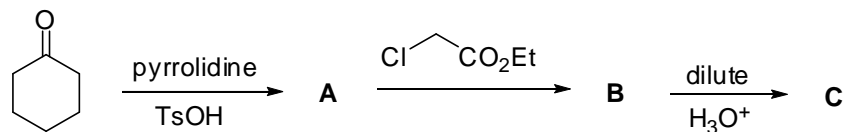


Draw the base-pairs involved in RNA and DNA, respectively.

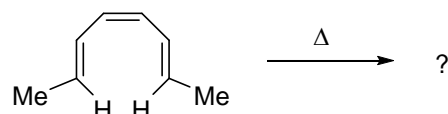
4. Answer *any one* question from the following:

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(a) Provide the structures **A-C** in the following conversion.

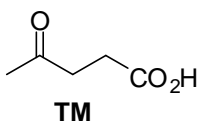


What product would you expect from the following thermal reaction? Justify your answer by drawing the FMOs involved.

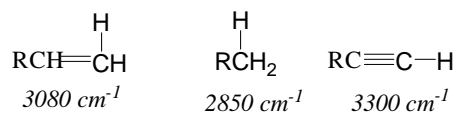


What do you mean by Umpolung reaction? Using this reaction strategy show the synthesis of acetophenone starting from benzaldehyde.

Synthesize the following target molecule (**TM**) from EAA. You may also use other necessary reagents and/or substrates.



(b) Given the stretching frequencies for the C-H bond shown. Arrange the corresponding bonds in order of increasing strength. Explain your reasoning.



Suggest the structure for compound with molecular formula $\text{C}_4\text{H}_{10}\text{O}$ from the following proton NMR spectral data.

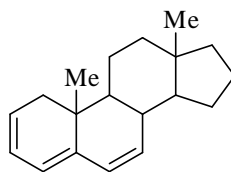
δ_{H} : 1.13 (3H, t, $J = 7$ Hz), 3.38 (2H, q, $J = 7$ Hz)

For each group of IR frequencies listed below, suggest the functional group that is present:

I) $2500\text{-}3500\text{ cm}^{-1}$ (broad, on top of C-H stretch), 1710 cm^{-1}

II) 3300 cm^{-1} (one peak), 1680 cm^{-1}

Use the Woodward-Fieser rules to predict λ_{max} value for the following structure:



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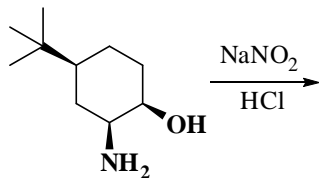
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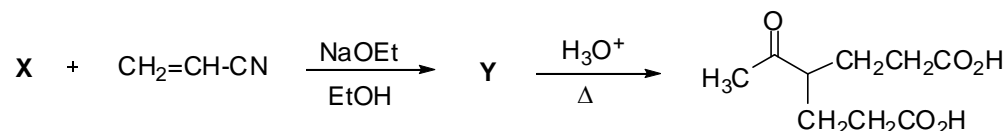
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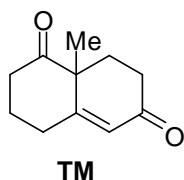
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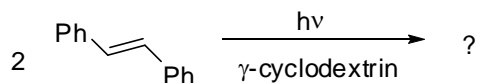
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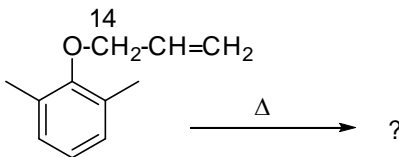
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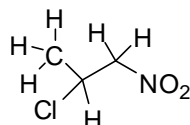


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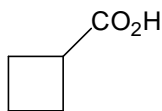
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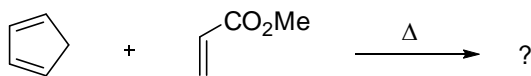
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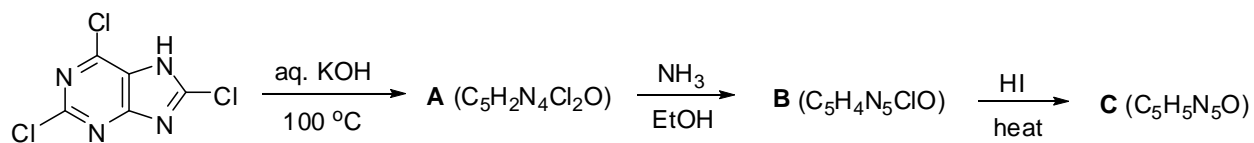
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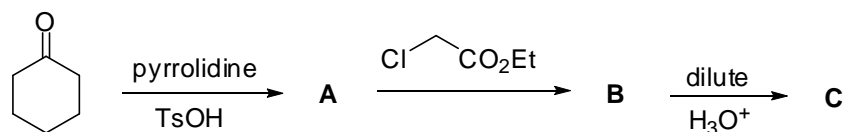


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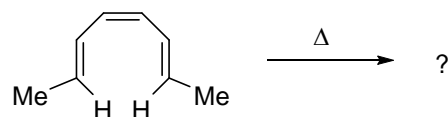
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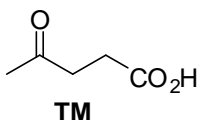


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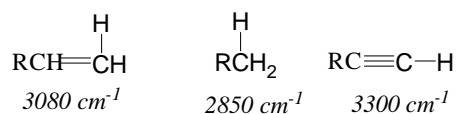


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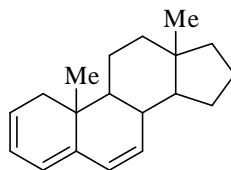
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