

2020

CHEMISTRY

[HONOURS]

Paper : X

Full Marks : 100

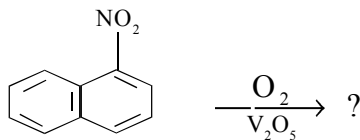
Time : 4 Hours

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

GROUP-A

1. Answer any **five** questions: 2×5=10

- a) What happens when 4-Phenyl but-3-enoic acid is warmed with H_2SO_4 ?
- b) Give product(s) in the following reaction:

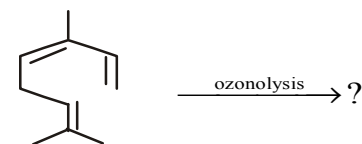


- c) Write the geometrical configuration of Citral-a and Citral-b.

- d) What is the stereoelectronic requirement for E-2 elimination reaction in cyclohexane system?
- e) What is anomeric effect?
- f) What is obtained after inverting the configuration of C-5 of D-Glucose?
- g) Why is Pyridine-N-oxide more reactive than Pyridine itself?
- h) What is 'isoprene rule'?

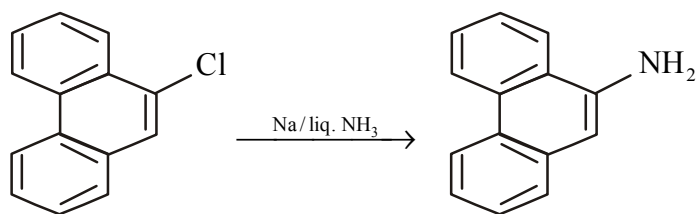
2. Answer any **four** questions: 5×4=20

- a) What happens when phenanthraquinone is warmed with alkali and the product is heated first and then oxidised? 3+2=5
- b) i) Draw a Fischer, Haworth Projection and chair conformations of β -D-Glucopyranose.
- ii) Why the anomeric-OH group undergoes methylation but others do not? 3+2=5
- c) i) Write down all the ozonolysis product of the following compound:



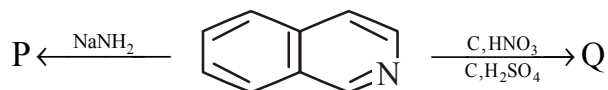
[Turn over]

- ii) Write a reasonable mechanism for the following reaction:

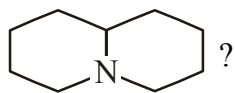


2+3=5

- d) i) What are P and Q in the following reaction?

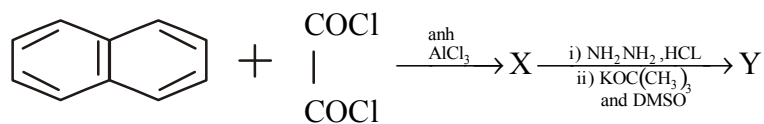


- ii) What product would you expect to get by the application of Hofmann's exhaustive methylation to



2+3=5

- e) i) What are X and Y in the following reaction scheme?



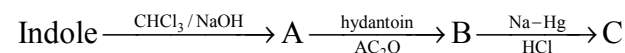
- ii) How many molecules of HIO₄ are required for complete oxidation of sucrose?

2+3=5

- f) i) Convert D(+) Glucose to D(-) Fructose.
ii) Synthesize 2-Ethylindole by Fischer's Indole synthesis. 2+3=5

3. Answer any **two** questions: 10×2=20

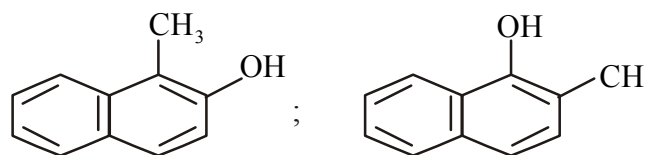
- a) i) What are A, B and C in the following reaction scheme?



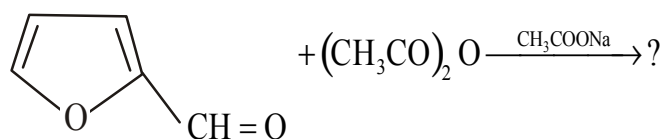
- ii) Furan acts as a good conjugated diene in Diels-Alder reaction but Pyrrole and thiophene do not. Explain.

- iii) Synthesize the derivative of quinoline starting from m-anisidine by skraup synthesis. State the role of each reagent used in this synthesis. 3+2(3+2)=10

- b) i) Which of the following two compounds will react with benzenediazonium chloride under basic condition to give azo-dye? Give reason.

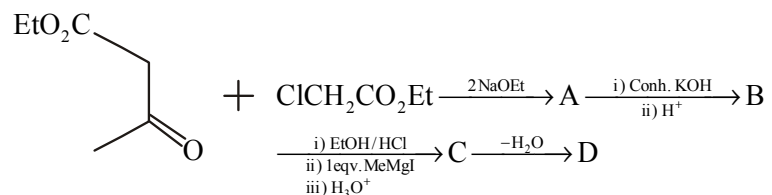


- ii) Write a detailed mechanism of glycoside formation when a small amount of gaseous HCl is passed into a solution of D(+) glucose in methanol.
- iii) D(+) glucose and D(-) Fructose give the same osazone with excess of Phenylhydrazine. Account for the observation.
- iv) Give product with mechanism:



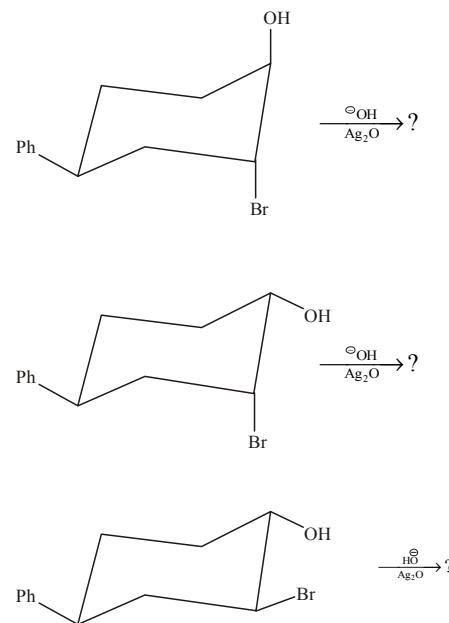
$$2+3+3+2=10$$

- c) i) Write the stereochemical structure of piperine. Synthesize piperine starting from catechol and other suitable reagent.
- ii) Write structures for A, B, C and D in the following reaction scheme:



$$(2+3)+5=10$$

- d) i) Name and give structures of the heterocyclic bases found in DNA. Write the structure adenylic acid.
- ii) Both *cis*- and *trans*-1, 2-dibromocyclohexane give the same product when heated with iodide salt. Identify the product and explain the reaction.
- iii) Identify the major product in each of the following reactions. Give reasons in short.



$$3+2\frac{1}{2}+(1\frac{1}{2}\times 3)=10$$

GROUP-B

4. Answer any **five** questions: $2 \times 5 = 10$

a) Which of the following vibrational moods show no IR absorption bands?

- i) Symmetric CO_2 stretch.
- ii) Symmetric $\text{O}=\text{C}=\text{S}$ stretch.
- iii) Symmetric $\text{NC}-\text{CN}$ stretch.
- iv) Antisymmetric $\text{O}=\text{C}=\text{O}$ stretch.

b) Draw the HOMO and LUMO of cyclobutadiene.

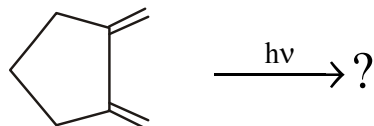
c) Define co-enzyme with example.

d) What do you mean by "Finger-Print region"?

e) λ_{max} Value of p-Aminophenol in water is longer than in acid solution. Justify.

f) Acetone absorbs light at 154, 190 and 280nm. Indicate what kind of transition causes each absorption.

g) Predict the product of the following reaction:



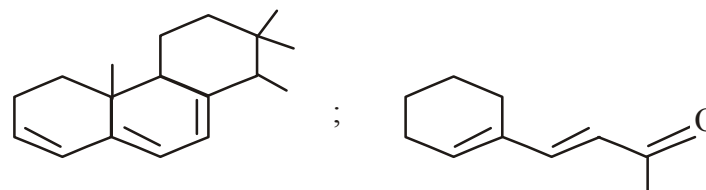
h) Write the Fischer projection formula of (L)-proline.

5. Answer any **four** questions: $5 \times 4 = 20$

a) i) Draw the Fischer projection formula of naturally occurring L-threonine.

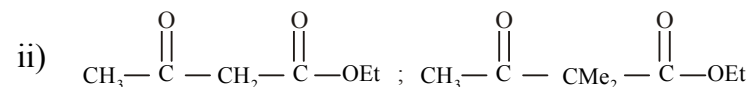
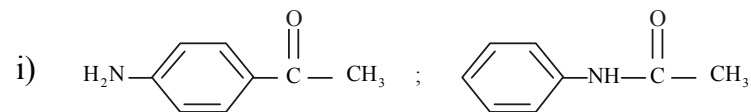
ii) What is DCC? Discuss the role of DCC in peptide synthesis. $2 + (1 + 2) = 5$

b) i) Calculate λ_{max} for the following compound according to Woodward-Feiser Rules:

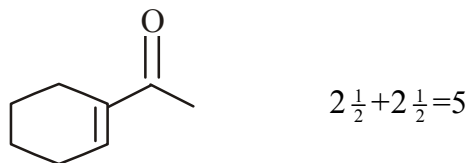


ii) Why TMS is used as standard in proton NMR spectroscopy? $3 + 2 = 5$

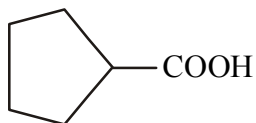
c) Distinguish between each pair of compounds using IR-spectroscopy:



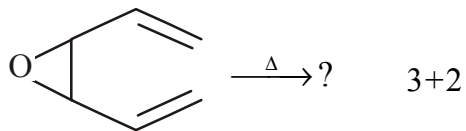
- d) i) Write the product with mechanism when Ninhydrine reacts with cysteine.
 ii) Design a suitable synthesis for the following target molecule:



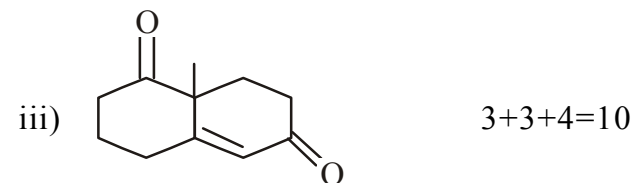
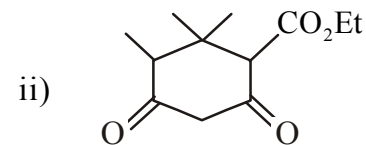
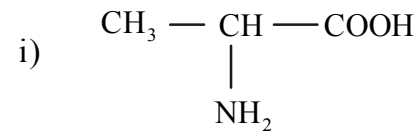
- e) i) Outline the successive degradation products of a nucleoprotein.
 ii) What is an auxochrome? What structural feature must an auxochrome possess?
 $2 + 3 = 5$
- f) i) Synthesize the following compound showing proper retrosynthetic analysis:



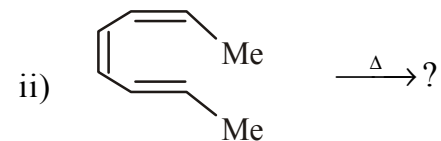
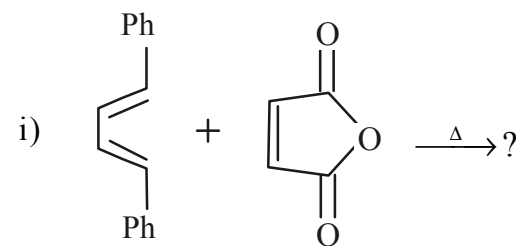
- ii) Write the product of the following thermal reaction:

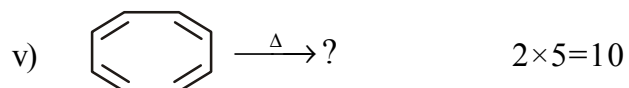
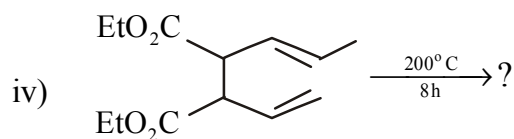
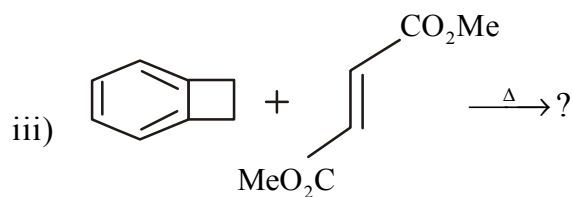


6. Answer any **two** questions: $10 \times 2 = 20$
 a) Synthesize the following compounds by showing proper retrosynthetic analysis:-

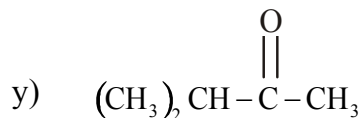


- b) Predict the product of the following reactions:

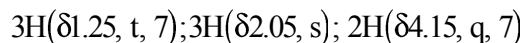




- c) i) Indicate chemically non-equivalent H's and predict their spinmultiplicity in the following compounds:



- ii) An organic compound $\text{C}_4\text{H}_8\text{O}$ has strong absorption in infrared at 1740 cm^{-1} and the following signals in its $^1\text{H-NMR}$ spectrum:



Suggest a structure for the compound.

- iii) Aspartic acid and Arginine can be easily separated by Electrophoresis. Justify the statement. $4+4+2=10$

- d) i) Synthesize (L)-Proline.
 ii) Discuss the role of 2, 4-DNFB for the determination of N-terminal residue of protein.
 iii) How would you differentiate chemically between the following peptides?
 Gly-Ala-Ala; Ala-Gly-Ala.
 iv) Comment on the active site of chymotripsin. $3+3+2+2=10$