

2023

CHEMISTRY — HONOURS

Paper : CC-12

(Organic Chemistry)

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.*Answer *question no. 1* (compulsory) and *any eight* questions from the rest (*question nos. 2 to 12*).1. Answer *any ten* questions :

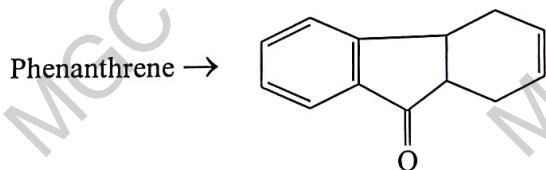
1×10

- (a) Explain why anthracene is more reactive than naphthalene towards Diels-Alder reaction.
- (b) What happens when pyridine is treated with sodamide (NaNH_2) in toluene and then quenched with water?
- (c) Draw the most stable conformation of *cis*-1,4-ditertiarybutylcyclohexane.
- (d) Give one example of [1, 5] sigmatropic rearrangement.
- (e) Write down the structure of one D-aldohexose that could be oxidised to *meso*-aldaric acid by nitric acid.
- (f) Draw the structure of the following tripeptide : Ala-Gly-Phe.
- (g) Name one aldohexose and one ketohexose which give the same osazone as D-mannose.
- (h) Why 1,4-disubstituted cyclohexanes are always achiral irrespective of the conformations and the nature of the substituents?
- (i) How do anomers differ from epimers?
- (j) Draw the preferred conformation of 1-methyl-1-phenylcyclohexane. (Structure only)
- (k) Write down the structure of Boc derivative of alanine.
- (l) Write down the reagent used in Sanger's method for N-terminal analysis of peptides.
- (m) Identify the product with stereochemistry of the following pericyclic reaction :



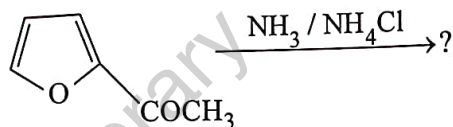
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2. (a) Carry out the following transformation :

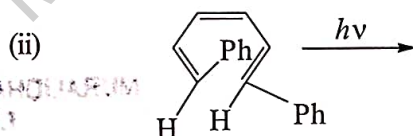
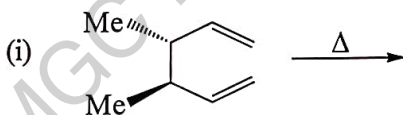


- (b) Predict the product with mechanism :

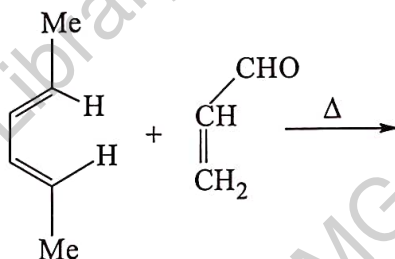
3+2



3. (a) Predict the products with stereochemistry of the following reactions :



- (b) Predict the major product of the following reaction from FMO consideration :



1½+1½+2

4. (a) Pyridine N-oxide is more reactive towards both electrophiles and nucleophiles. Explain.

- (b) Complete the following sequence of reactions :



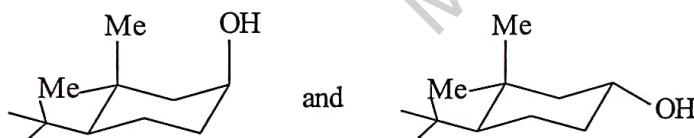
3+2

5. (a) When D-glucose is treated with aqueous $\text{Ca}(\text{OH})_2$ and the solution is allowed to stand for several days, a mixture of products results including D-mannose, D-fructose and D-glucose. Account for the mechanism of the reaction.

- (b) Why is sucrose called a non-reducing sugar? Explain with structure.

3+2

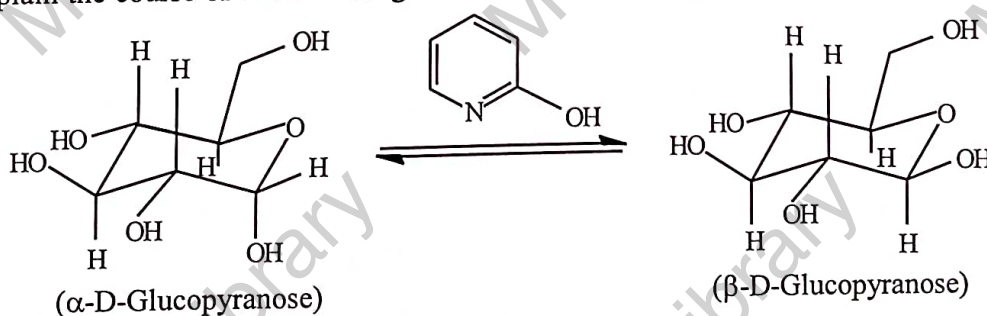
6. (a) When *trans*-4-tertiarybutylcyclohexylamine is treated with nitrous acid (HNO_2), the corresponding alcohol with retention of configuration is obtained; but in case of *cis*- isomer, cyclohexene is obtained. Explain with mechanism.
- (b) *trans*-1,2-diaxial cyclohexanehalohydrins undergo epoxidation several times faster than the diequatorial isomer. Explain. 3+2
7. (a) In thermal ring opening of *trans*-3,4-dimethylcyclobutane, two isomeric products are expected to be formed by the allowed conrotatory mode of rotation. However, only one product is obtained. Explain this observation.
- (b) Account for the fact that in cycloaddition reaction of cyclopentadiene with maleic anhydride, the less stable *endo*-adduct predominates. Explain by orbital interaction. 3+2
8. (a) How can you determine N-terminal amino acid of a peptide chain by Edman method? What advantage does it offer over Sanger's method?
- (b) How would you synthesise (\pm)-methionine using Strecker's method? 3+2
9. (a) Compare the rates of chromic acid oxidation of the following compounds with explanation.



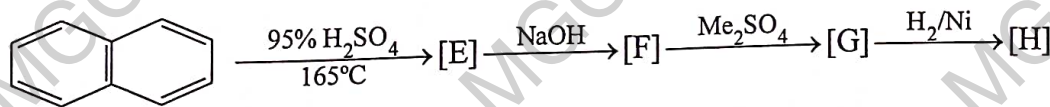
- (b) Predict the products of the following with suitable mechanism: 3+2



10. (a) Using solid phase peptide synthesis, prepare the dipeptide Ala – Gly.
- (b) How can lysine ($\text{pI} = 9.7$) be separated from alanine ($\text{pI} = 6.0$) by electrophoresis? 3+2
11. (a) Explain the course of the following reaction mechanistically:



- (b) Identify the compounds [E] to [H] in the following sequence of reactions: 3+2



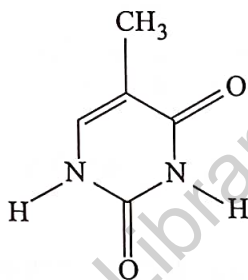
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12. (a) Explain the formation of different isomeric heterocyclic products obtained from reaction of ethyl acetoacetate and α -chloroacetone in the presence of

(i) aqueous NaOH.

(ii) NaI / EtOH / NaOEt followed by heating with oxalic acid at 100°C-150°C

(b)



(i) Name the base as shown above.

(ii) Name its complementary base present in DNA. (Structure not needed)

3+2

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