

2020

## CHEMISTRY — HONOURS

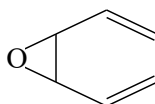
Paper : CC-12

Full Marks : 50

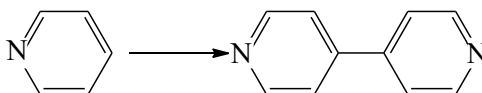
*The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.*Answer **question no. 1** (compulsory) and **any eight** questions from the rest.1. Answer **any ten** questions :

1×10

- (a) Write down the most stable conformation of *trans*-1, 4-dimethylcyclohexane.
- (b) Write the structure of the product when 2-methylfuran is treated with DMF-POCl<sub>3</sub>.
- (c) Draw the most stable chair conformation of 1-methyl-1-phenylcyclohexane.
- (d) Show the number of hydrogen bonds present in a guanine-cytosine base pair.
- (e) What is the effective structural unit necessary for osazone formation?
- (f) Name a reagent by which D-glucose and D-fructose can be distinguished chemically.
- (g) Write down the product of thermal sigmatropic reaction of the following molecule :



- (h) Draw the most stable chair conformation of methyl-D-glucopyranoside.
- (i) Write appropriate reagent for the following conversion :

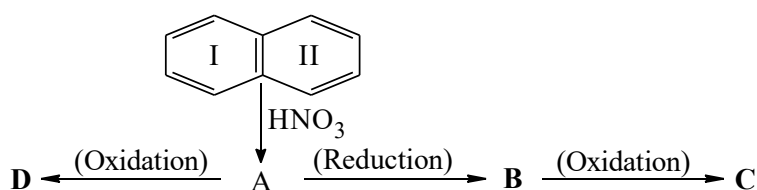


- (j) Define pericyclic reaction.
- (k) [2+2] Cycloaddition reaction is not a thermally favourable process— why?
- (l) Draw the complete structure of the peptide Gly-Phe-Ser.
- (m) Anthracene is more reactive at what positions and why?
2. (a) How will you prepare 3-nitropyrrole exclusively from pyrrole?
- (b) Carry out conversion of pyridine to 4-nitropyridine.

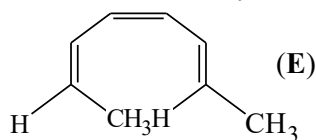
3+2

Please Turn Over

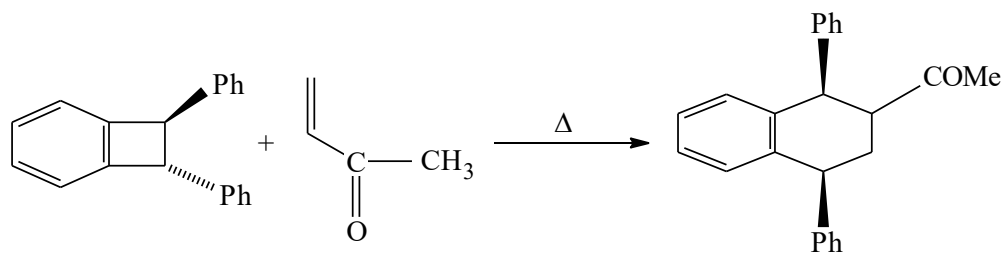
3. (a) Identify the starting materials and show the mechanism of the reaction to obtain the following product involving reaction indicated in the parantheses :  
3-Methylindole (Fischer indole synthesis)
- (b) Quinoline-2,3-dicarboxylic acid smoothly forms only quinoline-3-carboxylic acid via a selective decarboxylation. — Explain. 3+2
4. (a) *Trans*-2-aminocyclohexanol on treatment with aqueous  $\text{NaNO}_2$  and dilute  $\text{HCl}$  gives cyclopentane carboxaldehyde while its *cis*-isomer gives mixture of products. — Explain.
- (b) Explain why *cis*-4-hydroxycyclohexanecarboxylic acid lactonises on heating but the *trans*-isomer does not. 3+2
5. (a) Complete the following series of reactions and indicate at what conclusion would you achieve from it regarding the structure of naphthalene :



- (b) How would you synthesise anthracene taking Diels-Alder reaction as one of the steps involved in the synthesis? 3+2
6. (a) Predict the fate of the following compound **E** in the case of photochemical electrocyclic ring closure and explain the reaction on the basis of FMO theory :

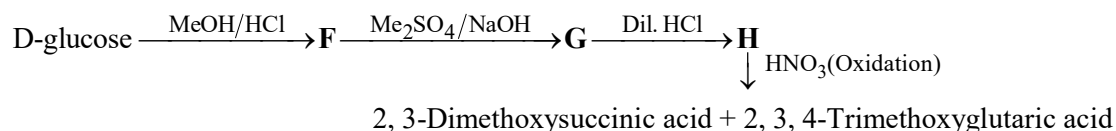


- (b) Thermal [1, 5] – H shift is facile but thermal [1, 3] – H shift is not observed. — Explain. 3+2
7. (a) Rationalise the following reaction by FMO, showing the steps of the reaction :

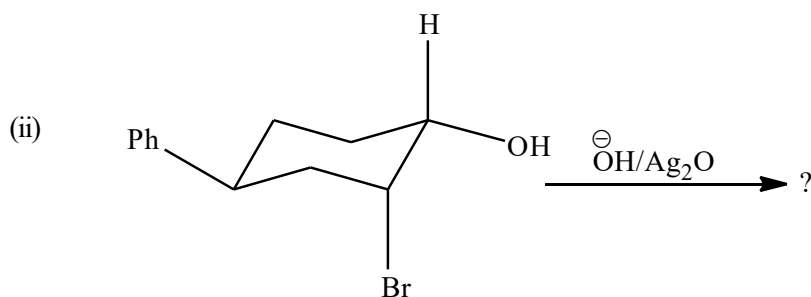
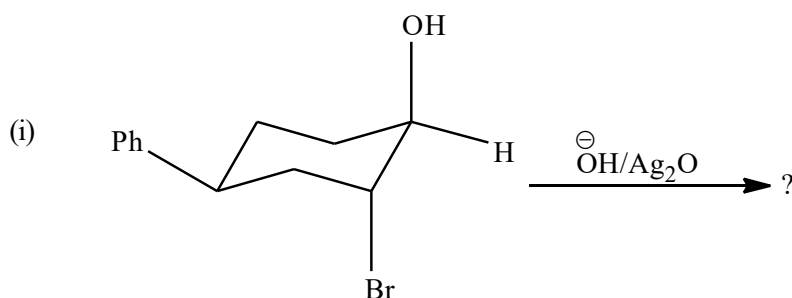


- (b) Using frontier orbital overlap, explain why Diels-Alder reaction between 1, 3-butadiene and ethylene is thermally allowed but not catalysed by UV light. 3+2

8. (a) Determine whether D-glucose possesses a furanose or a pyranose ring structure from the final product in the following reaction sequence :



- (b) The mutarotation of D-glucose in an aprotic solvent does not occur in the presence of pyridine alone or cresol alone; when both cresol and pyridine are present together, mutarotation of glucose takes place. Explain the observation with mechanism. 3+2
9. (a) How would you determine the N-terminal residue of a peptide following Edman's degradation method? Why is the method preferred over Sanger's method?
- (b) Guanosine is hydrolysed more rapidly than adenosine in dilute acid solution. Explain why. 3+2
10. (a) Write down a scheme for the synthesis of Gly-Ala using DCC promoted peptide bond formation. Give mechanism for the DCC coupling reaction step.
- (b) In an electric field, towards which electrode, would an amino acid migrate at a  
(i)  $\text{pH} < \text{pI}$ , (ii)  $\text{pH} > \text{pI}$ . Explain. 3+2
11. (a) Write down the products of the following reactions with plausible mechanism :



- (b) Explain the fact that *trans*-4-*tert* butylcyclohexyl tosylate undergoes bimolecular elimination with the bases bromide and thiophenolate, although not with the much stronger base ethoxide. 3+2