B. Sc. CHEMISTRY EXAMINATION, 2024

(5th Semester)

CHEMISTRY (CORE)

PAPER : CORE 12

Time : *Two Hours* *Full Marks* : 40

(*20 marks for each Unit*)

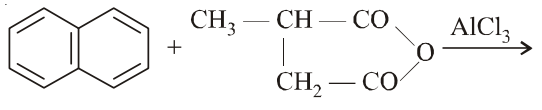
Use a separate answer scripts for each Unit.

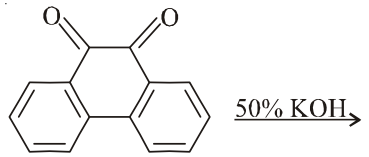
The figures in the margin indicate full marks.

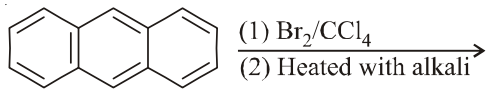
UNIT—5121 – O

1. *(a)* Synthesize anthracene by Diels–Alder reaction involving 1,4-naphthaquinone and 1,3-butadiene. 1½

(b) Predict the product(s) with plausible mechanism of the following reactions (***any two***) : 1½×2

(i) 

(ii) 

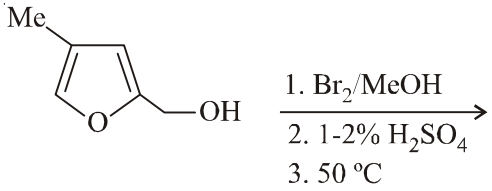
(iii) 

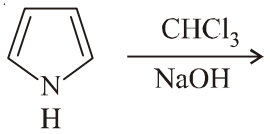
2. *(a)* Answer ***any one*** of the following questions : 1½

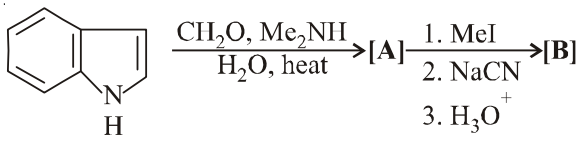
(i) Pyrrole undergoes electrophilic attack at C-2 position whereas indole undergoes electrophilic attack at C-3 position — justify the statement.

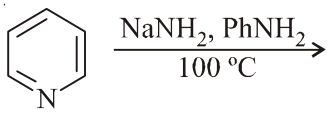
(ii) Furan undergoes Diels-Alder reaction with maleic anhydride whereas pyrrole does not. Explain.

(b) Predict the product(s) of the following reactions with plausible mechanism (***any two***) : 2×2

(i) 

(ii) 

(iii) 

(iv) 

(iii) Although 'Dewar benzene' is less stable by 60 kcal than its isomer benzene, its conversion into benzene is surprisingly slow (E_{act} is 37 kcal). Explain this observation.

5. Answer ***any five*** of the following questions : 2×5

(a) Explain the stepping-up or stepping-down methods of aldoses.

(b) Explain Lobry de Bruyn-van Ekenstein rearrangement.

(c) What is anomeric effect? Explain.

(d) What is isoelectric point? How is it measured for amino acids with neutral, acidic and basic side chain residue?

(e) Explain the Strecker and Azlactone method of synthesis of α-amino acid.

(f) Explain Fischer glycosidation procedure.

(g) Write down the structure of four different nucleobases found in DNA and the H-bonding pattern found in Watson-Crick model of DNA.

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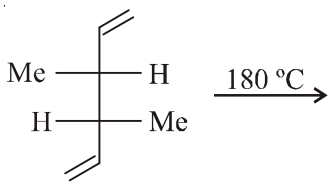
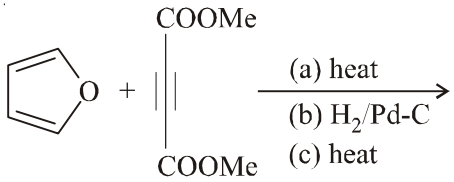
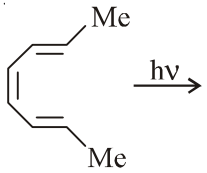
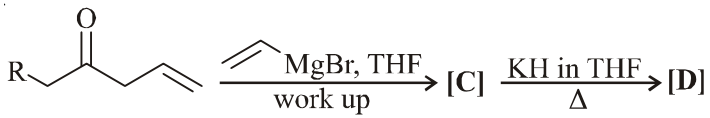
(ii) 

(iii) 

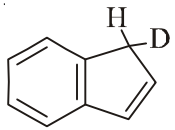
(iv) 

(b) Answer ***any two*** of the following questions : 2×2

(i) Identify **[C] & [D]** in the following reaction sequence. Explain with mechanism.



(ii) Heating of indene derivative **[E]** causes the scrambling of the labeled deuterium atom to all the three non-aromatic positions. Explain mechanistically the above observation.



[E]

3. *(a)* Describe schematically resolution of *racemic*-2-amino-butane using (*S*)-2-hydroxy-2-phenylethanoic acid as resolving agent. Give also the chemical reaction(s) involved. 2

(b) Draw the most stable conformation of *cis*- and *trans*-1,2-dimethylcyclohexane in Newman projection. Compare their stability with justification. 2

(c) What is/are the product(s) obtained on acetolysis of optically pure *trans*-2-acetoxycyclohexyl tosylate? Give suitable mechanistic and stereochemical explanation. 2½

(d) How many pairs of enantiomers are possible for 2-isopropyl-5-methylcyclohexanol? Draw its most stable enantiomeric pair in chair form. What happens when any one of these two enantiomers is treated with sodium hydride/carbon disulfide followed by methyl iodide and then the product(s) obtained is/are strongly heated? Explain this phenomenon with appropriate mechanistic and stereochemical interpretation. 3½

UNIT—5122 – O

4. *(a)* Predict the product(s) with proper stereochemistry of the following reactions and explain with FMO consideration (Answer ***any three***) : 2×3

(i)