

**UNIVERSITY OF ESWATINI**  
**FINAL EXAMINATION – 2019**

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**TITLE OF PAPER** : Advanced Organic Chemistry

**COURSE NUMBER** : C 403

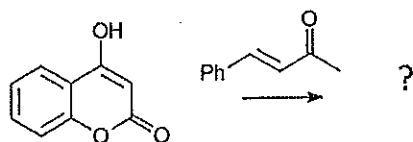
**TIME** : Three Hours

**INSTRUCTIONS:**

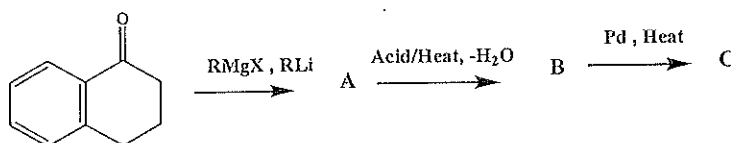
This paper has six (6) questions. Answer any four (4) of the seven questions. Each question has 25 points and all questions are to be answered in a separate answer sheet.

## Questions 1

- How would you explain the impact of Ortho, Para and Meta directing groups in pyridine and pyridinium salt heterocyclic substitutions? (4)
- Complete the following reaction in a basic media. (3)

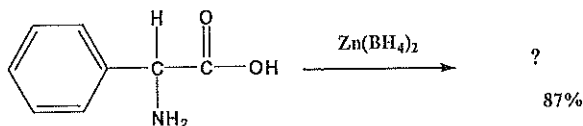


- Structurally show aldol condensation of aldehydes. (4)
- Discuss “2+3” and “3+3” Strategies in heterocyclic synthesis giving oxygen nitrogen heterocyclic compounds as examples. (4)
- Compare the reactivity of heterocyclic compounds Pyrrole, Furan and Thiophene with their saturated forms Pyrrolidine, THF, THT. Explain your comparisons. (6)
- Give the structure of A, B and C in the sequence of reactions bellow. (4)



## Questions 2

- What is the meaning of a zwitterion? Give examples of polar, nonpolar and neutral zwitterions relevant to protein formation. (4)
- What is the role of macromolecule insulin in the human body? What is the chemical nature of insulin? (4)
- What are the roles of enzymes in the human body? (5)
- Why is water called solvent of life? What are the unique properties of water that make it to be a very versatile solvent? (7)
- Complete the following reaction which is common with amino acids. (5)

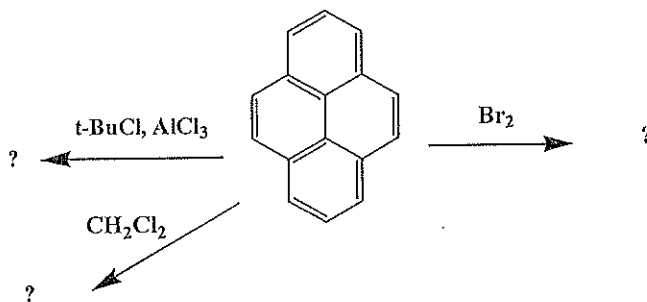


### Questions 3

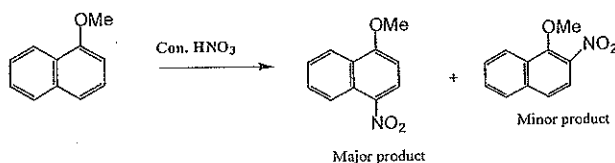
- a) Give the names and chemical structures of Testosterone, Estrogen and progesterone. Explain their role in the human body including their behavioral roles. (10)
- b) There are two steroidal hormones in two separate bottles and both having secondary alcohols and reacted with  $\text{LiAlH}_4$ . One of the bottles A reacted and generated heat while bottle B did not give any sign of reaction. What is the identity of hormone A and hormone B? (4)
- c) How are steroids absorbed in the body? What are the uses of steroids? Which cholesterol isomer is physiologically active? (7)
- d) Give examples of steroidal contraceptives that are still in use. (4)

### Questions 4

- a) Give the products of the following reactions. (6)



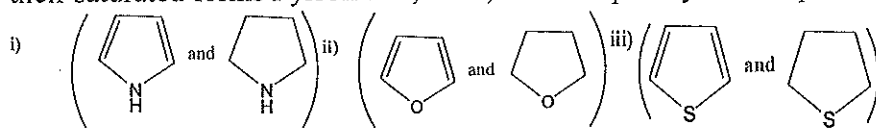
- b) A compound B which is aromatic has  $^1\text{H NMR}$  signals at  $\delta$  4.02s (3H), 7.25d (1H), 8.45d (1H), 8.75s (1H) and a molecular formula of  $\text{C}_6\text{H}_6\text{O}_5\text{N}_2$  with two nitro groups and a methoxy. Give the structure of the molecule and indicate the position of the different signals and groups in the structure. (4)
- c) Give reasons why the reaction below is going as indicated. (4)



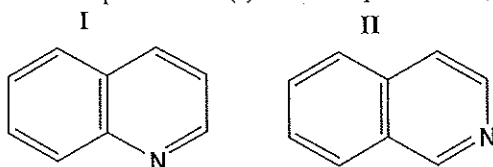
- d) What starting material and reactants would you use in the synthesis of Anthracene (Bradsher reaction)? (4)
- e) Give two important properties of aromatic polyenes. (2)

## Questions 5

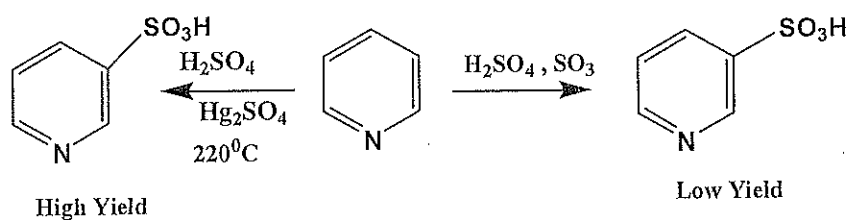
- a) Compare the reactivity of heterocyclic compounds Pyrrole, Furan and Thiophene with their saturated forms Pyrrolidine, THF, THT. Explain your comparisons. (9)



- b) Considering the structures of quinolone (I) and Isoquinoline (II)



- i) Under strongly acidic conditions where will the reaction take place? and why? (6)
- ii) Which ring is more reactive the benzo-ring or the hetero-atom ring? (2)
- iii) Where will the rate of acidic reaction be faster? (2)
- d) Discuss the reaction mechanisms of these two reactions. Give reasons why there is low yield expected for ii as compared to i? (6)



## Questions 6

- a) Discuss the biosynthesis of the following classes of natural products giving examples of each.

- i) Steroids (5)

ii) Alkaloids (5)

iii) Flavanoids (5)

b) Why do we study the natural products? (5)