UNIVERSITY OF SWAZILAND

FINAL EXAMINATION – 2016

TITLE OF PAPER : Advanced Organic Chemistry

COURSE NUMBER : C 403

TIME : Three Hours

INSTRUCTIONS:

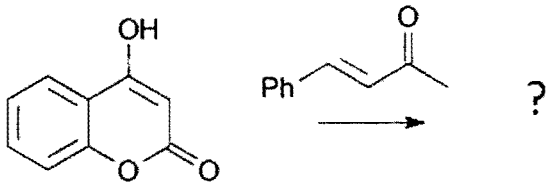
This paper has five pages and seven questions. Answer any five of the seven questions. Each question has 20 points and all questions are to be answered in a separate answer sheet.

Questions:

1 a) How would you explain the impact of ortho, para and meta directing groups in pyridine and pyridinium salt heterocyclic substitutions? (4)

b) i) What is the difference between reducing and non-reducing sugars?
ii) Among the reducing and non-reducing sugars, which one is more reactive? Give an example of each? (5)

c) Complete the following reaction in a basic media. (3)



d) Structurally show aldol condensation. (4)

e) Discuss "2+3" and "3+3" Strategies in heterocyclic synthesis giving oxygen nitrogen heterocyclic compounds as examples. (4)

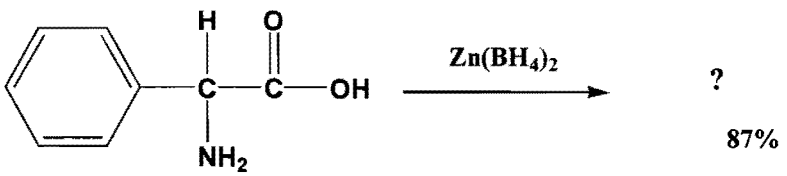
2 a) What is the meaning of a zwitterion? Give examples of polar, nonpolar and neutral zwitterions relevant to protein formation. (4)

b) What is the role of macromolecule insulin in the human body? What is the chemical nature of insulin? (4)

c) What are the roles of enzymes in the human body? (5)

d) Why is water called solvent of life? What are the unique properties of water that make it to be a very versatile solvent? (4)

e) Complete the following reaction which is common with amino acids. (3)

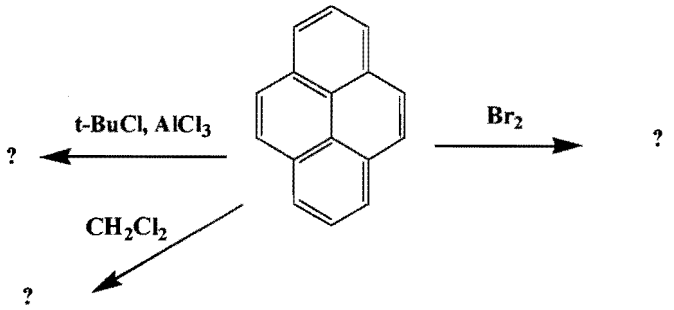


3 a) Give the names and chemical structures of the immediate precursors of Testoterone, Estrogen and progesterone. (8)

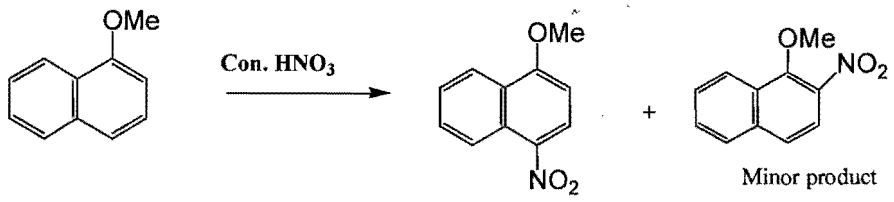
b) There are two steroidal hormones in two separate bottles and both having secondary alcohols and reacted with $LiAlH_4$. One of the bottles **A** reacted and generated heat while bottle **B** did not give any sign of reaction. What is the identity of hormone **A** and hormone **B**. (4)

c) How are steroids absorbed in the body? What are the uses of steroids? Which cholesterol isomer is physiologically active? (8)

4 a) Give the products of the following reactions. (4.5)



b) Give reasons why the reaction below is going as indicated. (3)

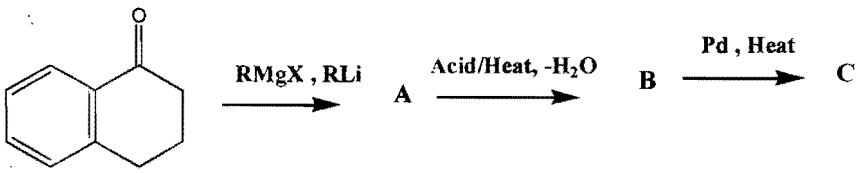


Major product

Minor product

c) What starting material and reactants would you use in the synthesis of Anthracene (Bradsher reaction)? (3)

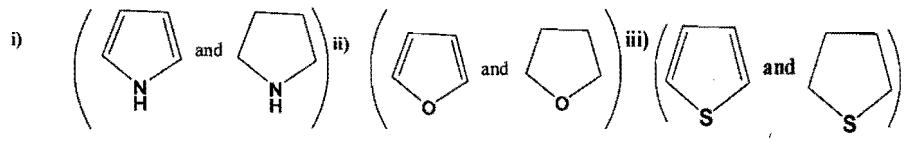
d) Give the structure of A, B and C in the sequence of reactions bellow. (4)



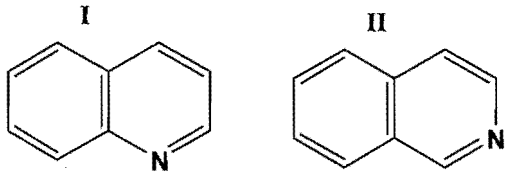
e) Give two important properties of aromatic polyenes. (2)

f) A compound **B** which is aromatic has ^{1}H NMR signals at δ 4.02s (3H), 7.25d (1H), 8.45d (1H), 8.75s (1H) and a molecular formula of $C_6H_6O_5N_2$ 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. (3.5)

5. a) Compare the reactivity of heterocyclic compounds Pyrrole, Furan and Thiophene with their saturated forms Pyrrolidine, THF, THT. Explain your comparisons. (6)



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

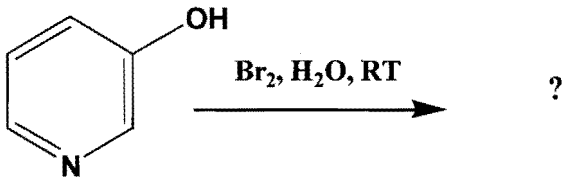


i) Under strongly acidic conditions where will the reaction take place? and why? (3)

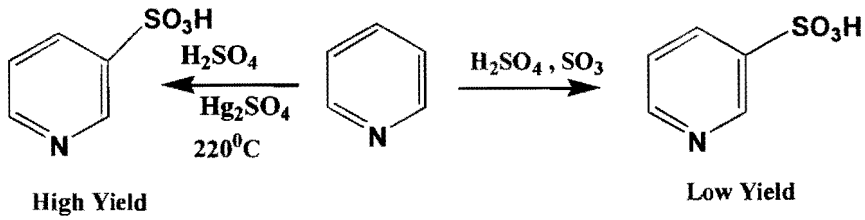
ii) Which ring is more reactive the benzo-ring or the hetero-atom ring? (2)

iii) Where will the rate of acidic reaction be faster? (2)

c) Give the final product of the following reaction. (3)



d) Discuss the reaction mechanisms of these two reactions. Give reasons why there is low yield expected for **ii** as compared to **i**? (4)



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

i) Steroids (5)

ii) Alkaloids (5)

iii) Carbohydrates (5)

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

7. a) What is starch? Hydrolysis of starch gives a cyclic monomer. Explain the chemistry of the monomer and draw its structure. (5)

b) Indicate what type of linkage is exercised by the monomer in building starch. (4)

c) How would you differentiate between the structures of starch, glycogen and cellulose? (3)

d) What difference is found in the function of these three polymers? (4)

e) What are the uses of carbohydrates in animals? (4)